Better Crops with PLANT FOOD

December 1941 10 Cents

The Pocket Book of Agriculture

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Potash Pays on Grain (South)
Greater Profits from Cotton
Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Grow More Corn (South)
Fertilizing Small Fruits (Pacific Coast)
Potash Hungry Fruit Tree (Pacific Coast)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (Northeast) and (Canada)
Fertilize Pastures for Better Livestock (Pacific Coast)
What You Sow This Fall (Canada)
Home-grown Grains for Profitable Hogs (Canada)
What About Clover? (Canada)

Reprints

D-7 Successful Strawberry Practices (South)
R-7 Results with Potash in Eastern Virginia
Z-7 Boron Prevents Darkening of Turnips
HH-7 High Potash Fertilizers for Fall Use
B-8 Commercial Fertilizers in Grape Growing
C-8 Peanuts Win Their Sit-down Strike
K-8 Safeguard Fertility of Orchard Soils
T-8 A Balanced Fertilizer for Bright Tobacco
CC-8 How I Control Black-spot
GG-8 Soil and Fertilizer Needs of Apple Orchards
IIII-8 Boron Deficiency in Michigan
II-8 Balanced Fertilizers Make Fine Oranges
MM-8 How to Fertilize Cotton in Georgia
NN-8 Does Weather Affect Tomato Yields?
A-9 Shallow Soil Orchards Respond to Potash
C-9 Fertilizing Hops for More Profit
N-9 Problems of Feeding Cigarleaf Tobacco
P-9 Borax for Alfalfa in Northern Idaho
R-9 Fertilizer Freight Costs
T-9 Fertilizing Potatoes in New England
X-9 Hershey Farms Find Potash Profitable
CC-9 Minor Element Fertilization of Horticultural Crops
DD-9 Some Fundamentals of Soil Management
JJ-9 It Pays to Balance Your Soil Fertility
KK-9 Florida Studies Celery Plant-food Needs
MM-9 Fertilizing Tomatoes in Virginia
NN-9 Grass Is a Crop, Treat It as Such
PP-9 After Peanuts, Cotton Needs Potash
UU-9 Oregon Beets and Celery Need Boron
A-2-40 Balanced Fertilization For Apple Orchards
B-2-40 Pasture Problems Still Unsolved
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
H-3-40 Fertilizing Tobacco for More Profit
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
K-4-40 British Columbia Uses Boron for Fruit
M-4-40 Ladino Clover "Sells" Itself
N-4-40 How Shall We Fertilize Vegetable Crops?
O-5-40 Legumes Are Making A Grassland Possible
Q-5-40 Potash Deficiency in New England
S-5-40 What Is the Matter with Your Soil?
T-6-40 3 in 1 Fertilization for Orchards
Y-8-40 The Use of Fertilizers in Soil Conservation
Z-8-40 Permanent Pasture Treatments Compared
AA-8-40 Celery—Boston Style
CC-10-40 Building Better Soils
DD-10-40 Potato Growing Trends
EE-11-40 Research in Potash Since Liebig
GG-11-40 Raw Materials For the Apple Crop
II-12-40 Podzols and Potash
JJ-12-40 Fertilizer in Relation to Diseases in Roses
KK-12-40 Better Pastures for Better Livestock
LL-12-40 Tripping Alfalfa
A-1-41 Better Pastures in North Alabama
B-1-41 Our Defense Against Soil Fertility Losses
C-1-41 Further Shifts in Grassland Farming?
D-1-41 How, Where, When Apply Fertilizers?
E-2-41 Use Boron and Potash for Better Alfalfa
F-2-41 Meeting Fertility Needs in Wood County, Wisconsin
I-3-41 Soil and Plant-tissue Tests as Aids in Determining Fertilizer Needs
J-3-41 Soil, The Substance of Things Hoped For
K-4-41 The Nutrition of Muck Crops
L-4-41 The Champlain Valley Improves Its Apples
M-4-41 Available Potassium in Alabama Soils
N-5-41 Soil Productivity in the Southeast
O-5-41 Synthetic Wood Ashes Require Boron
P-6-41 The Making of Better Pastures
Q-6-41 Plant's Contents Show Its Nutrient Needs
R-6-41 A Balanced Diet for Nursery Stock
S-6-41 Boron—A Minor Plant Nutrient of Major Importance
T-6-41 The Concept of Available Nutrients in the Soil
U-8-41 The Effect of Borax on Spinach and Sugar Beets
V-8-41 Organic Matter Conceptions and Misconceptions
W-8-41 Cotton and Corn Response to Potash in South Carolina
X-8-41 Better Pastures for North Mississippi
Y-9-41 Ladino Clover Makes Good Poultry Pasture
Z-9-41 Grassland Farming in New England
AA-9-41 The Newer Ideas About Fertilizing Orchards
How to Determine Fertilizer Needs of Soils

THE AMERICAN POTASH INSTITUTE
1155 16TH STREET, N. W. WASHINGTON, D. C.

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington, D. C.

VOLUME XXV NUMBER 10

TABLE OF CONTENTS, DECEMBER, 1941

Arguing with Angels 3
Won't Win the War Says Jeff

A Five-year Program for Corn-Livestock 6
Described by H. B. Franklin

Borax Helps Prevent Alfalfa Yellows in Tennessee 10
According to H. E. Hendricks

Some Newer Ideas on Orchard Fertility 13
Are Advocated by F. N. Fagan

Plant Symptoms Show Need for Potash 17
In Experiments Reported by R. L. Cook

Potash Demonstrations on State-wide Basis 21
R. W. Shoffner Outlines Plans

The American Potash Institute
Incorporated

American Chemical Society Building, 1155 16th Street, N. W., Washington, D. C.

J. W. TURRENTINE, *President*

Washington Staff

J. D. Romaine, *Chief Agronomist*
Dale C. Kieffer, *Economist*
R. H. Stinchfield, *Publicity*
E. L. Ingraham, *Motion Pictures*
Mrs. C. M. Schmidt, *Librarian*

Branch Managers

S. D. Gray, *Washington, D. C.*
H. B. Mann, *Atlanta, Ga.*
G. N. Hoffer, *Lafayette, Ind.*
M. E. McCollam, *San Jose, Calif.*
E. K. Hampson, *Hamilton, Ont.*

"SILENT NIGHT" IN THE COUNTRY

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY. COPYRIGHT, 1941, BY THE BETTER CROPS PUBLISHING CORPORATION.

VOL. XXV WASHINGTON, D. C., DECEMBER 1941 No. 10

This Christmas are we . . . . .

Arguing with Angels

Jeff McDermid

WHEN the Sunday school supervisor who ran a barber shop put on his cotton whiskers and talked about "Peace on earth, good will toward men," all the kids in our class snickered. But we laughed at old Charley's make-up and not at the words of the angels. Are the angels still in good standing?

"Peace on earth, good will toward men" as the age-old Christmas message divides itself into two phrases for us plain folk this Yuletide. If we are cynical and realistic, we reject the first one as entirely obsolete; and from this standpoint we find it natural to slide past the second phrase without giving it much thought.

"Why cry peace when there is no peace?" I hear you say. And if you give a second glance at the last phrase at all, it is only to remind yourself of many opinions antagonistic to your own and to feel that if there were really "men of good will" in high places, there would be peace and lasting peace, and less bad reasoning and bitterness.

But to me it seems that peace is like any other mighty much-sought thing of our heart's desire. That is, to attain it we must prepare ourselves and subdue our passions and deny our cravings and be tolerant and keep a bright light burning in our souls for those who blunder and grope and grieve.

Peace is not just a status quo and a quiet, much-desired haven, for that indeed could be said of the grave. Peace to me implies that we must have gone through stress and turmoil and have

earned our reward and know how to accept it and turn it to good ends. Peace is truly the great desirable good, the attainable goal after the long race, the prize after the climb, the fruit after the hard labor and sacrifice—not merely a period of rest, of dull do-nothing and of sleep and forgetting.

It is so easy to cast off Christian sentiments and call them shibboleths and dreams that have tarnished and decayed. It is so easy to do this because there are folks who observe Christmas on both sides of this world conflict, and so we get confused and agnostic in trying to fathom their divers viewpoints across the time-worn pages of the same familiar testament. We read texts and so do they. We may be reading the new version and they may have the old one, but it's religion just the same. We often sing the same hymns no doubt, although the language differs. We listen to sermons in hushed somnolence, while theirs are punctuated by the gunfire of other soldiers who are or used to be "Christian soldiers." No wonder we hold our thumbs in the ritual and wonder what there is in it for us.

BRINGING it home to us in our own land, we too, have known a time of hovering war clouds blotting out the verdant sunshine of four bitter years. Both sides in that sanguinary conflict were led by more or less religious generals and captains courageous, who prayed for victory at any cost to attain a Peace which they wanted shaped to their own pattern. Soldier lads on both sides toted bibles and wrote home to mothers who were church members, often of the same church. Yet each side accused the other of un-Christian motives and unholy methods.

For all of that, when Peace came it had little of the balm and satisfaction which either side had hoped and fought for. In some respects for the time being it proved no better than the war itself. In other words, it's the let-down, the reaction leading to demoralization, which makes peace so dangerous and unhappy after the discipline and agony of feverish strife. It happened thus to us in '65 and in 1918 too. Will it involve us once more in negative action after the end of this one?

In the present unpleasantness around the globe we Americans have been dubbed the "haves" by certain men of Middle Europe who chose to be the "have nots" in everything but militarism. Although we are the "haves," we have apparently resolved not to do things by "halves." The present "peace" is surely anything but a comforting one. It's a sort of Irish peace as it were —a state of poised belligerence.

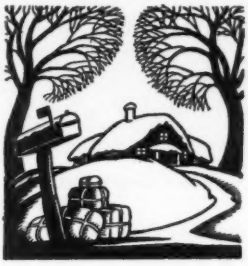
Surely this puts a strain on any but the most self-assured kind of practical Christianity. It leaves the orthodox votary and the ritualist out on a shaky mental limb. Preachment and parchment, sermon and scroll, symbol and saint get all muddled up over the situation and start arguments among us.

But if we stick to the role thrust upon us, and remember we are regarded as the "haves" of both hemispheres, maybe we can bring our religion close to the peace table, if and when they get around to setting it. However, in doing this it's a question of how we use that of which we are presumed to have such a surplus.

WE are the arsenal, the treasury, and the food reservoir of the world. So much for the material and the mundane part of it. What else have we to rely upon in the surplus line? That's where we must do our digging and preparing. It's the spiritual and psychological surplus we need to be thinking about while we are priming the guns, speeding the plows, and spending the money.

To begin with, we've got to prepare for peaceful agreement and peaceful production here at home, right in our own arsenals and agriculture, before we get any complimentary tickets to the peace table abroad. Until we learn to live with one another and submerge selfishness, and sort of practice for peace, we are bound to be one of the "have nots," believe it or not.

Some of us are talking about a truce on social reform and uplift agencies, believing that we can't go all out for Hitler's scalp and engage in home housecleaning at one and the same time. On the contrary, a state of war nerves multiplies the symptoms of such disorders and demands as much control as ever, or even more. As the cartoonist might draw it, a nation with boils on its bottom can't sit easy at the peace table for many courses of controversy.



We talk and brag more or less about our traditional American glories and virtues, which is a perfectly pardonable attitude. I've outdone my neighbors swaggering around extolling the courage and patriotism of my forebears, but I myself have not been put to the test very much.

My excuse for that might be that there aren't any wildcat wildernesses or crude cabins to freeze in, or lurking Injuns to scalp. Of course I went west in my advanced teens and helped my folks squat it out on a quarter-section claim that nobody much wanted to buy afterward. Going without our Sunday paper and telephone and missing ice cream for dessert constituted most of the hardship we had. Probably if we had known about the radio in those days, we would have squawked until we got a mail-order crystal set, despite ample coyote music.

When we make America safe for the Americans by paying more attention to little everyday kindness and solicitude and absorb a bit more public spirit at some sacrifice, and stop pestering Santa Claus for a lot of junk we don't earn—then I figure we'll blend this Christmas spirit into a force more powerful than anything despots created or fanatics fumbled.

In every settlement there is a "set" of critters who belie the American historical tradition for taking it on the chin. Now I am not pointing to any of them as appeasers or pacifists, because some are and some don't know enough to think either way. What I am saying is that we have bellyachers among our unwanted surplus, and as Europe has too many now it doesn't look like much of an export season. Meanwhile, these bellyachers keep on stuffing themselves just the same.

I HAVE acquaintances (not yet ripe enough for friends) who rave and froth at the mouth about impending income taxes, property levies, street improvements and sewage assessments, welfare doles, and everything else that seems to them to bar their pristine and inviolate freedom. Yet many a head of such houses (and a plague on them maybe) are known to smuggle in casks and flagons of liquid loquacity without question of excise fees or dispenser's margins. They'll invite you in and cuss the government for taxes and berate the farmer for the high cost of chicken and custard, while they slop out the highballs without a murmur or a hint of national doom.

I would be the last man to deny the citizen his inherent right to grumble. My wife has taken me up on that plenty, and I'm in no position to exclude myself from the suspect class. But I try not to do it so much at Christmas and I always confine my grumbling to private matters rather than yanking tail-feathers out of the E Pluribus eagle.

Being forthright and showing forbearance toward our armed forces (our kids in camp) appear also to be something most of us can attempt. It isn't enough to knit socks and mufflers or send them jumbled junk. The main thing is to cut out the sympathy racket. It's not "good will toward men."

I know a family where the pa and

(*Turn to page* 47)

Edwin Boss and Brother inspecting corn that took first prize in 1939.

A Five-year Program for Corn-Livestock

By H. B. Franklin

County Agricultural Teacher, Moultrie, Georgia

WHEN a farming community decides that it is necessary to add to its cash income, one of two things usually happens. Farmers either increase the acreage of their best paying cash crop or look for an entirely new crop enterprise. This situation faced the citizens of Colquitt County, Georgia, in 1938. The three primary cash crops, limited in acreage, were bringing in too small an income to meet the needs of the farming population. In three years the farmers have developed a cash crop that is adding at least $500,000 annually to their income.

This was accomplished without following either of the time-honored methods. Instead, two minor cash enterprises in the county were combined in such a manner as to make them pay off in a big way. By applying modern methods of production to the corn acreage and then in turn feeding this corn to good livestock, both hogs and cattle, a new source of income that bids fair to outrival all other crops in the territory and to become the mainstay, not only of this South Georgia County but of the entire Southeast, has been found. Behind this movement and in its accomplishment is a story of rural-urban cooperation and of clear thinking on the part of farm leaders that is well worth emulating.

Early in the winter of 1939 a small group of businessmen of Moultrie,

aware of the inter-dependence of urban and rural communities, listened to a plan for increasing livestock production in the county. For several years before that the county had averaged around 75,000 acres of land in corn production. The average yield for the previous 15 years was 11.3 bushels per acre; for Georgia, it was close to 10 bushels. Many Coastal Plains counties were fully as low as the State average. These figures are based on U. S. Department of Agriculture reports. Corn acreage producing such low yields as this doubtless led to the old cries, familiar to Southern farmers: "It costs a dollar a bushel to produce corn in Georgia," and "I can buy corn cheaper than I can grow it." Repeated so long and so often that many farmers believed them, these sayings unconsciously had their effect in low yields of corn and lack of attempt to improve or change the practices that tend to make costly yields. In other words, the farmers had been growing "dollar" corn.

It was pointed out that there is no law against higher corn production and that whenever and wherever a farmer has put into his corn production the proper care and attention, using fertilizers and ploughing under humus in sufficient quantities, he has been able to produce quite satisfactory yields at a cost low enough to allow the feeding of his corn to livestock and making a profit therefrom.

A plan for a 5-year 10-acre corn production contest was proposed and adopted. Each farmer participating was to enter at least 10 acres of corn in the contest. The county was divided into four districts and the corn into two classes, solid corn and interplanted corn. Duplicate prizes were offered in each district and in each class. This made a total of eight prizes of a kind. First prize was a purebred bull calf, second prize a ton of fertilizer, third and fourth prizes purebred pigs. The businessmen, through the local Chamber of Commerce, agreed to furnish the money for the prizes. It was pointed out that by increasing corn yields from 11.3 bushels per acre to an average of 40 bushels and in turn feeding this corn to good livestock, the farmers' income could be increased $2,000,000 annually.

This plan was presented to the farmers by the vocational teachers in all their evening and part-time class work. The county agent mailed letters and application blanks, and the local papers gave publicity to the plan and its progress. About 200 farmers entered the contest for the first year with 2,000 acres of corn.

Edwin Boss and the purebred Hereford bull calf he won.

When measuring time came, the agricultural workers measured each 10-acre plot. The first year yields were quite satisfactory, the highest yield in solid corn being 622 bushels on the 10 acres. The top yield in interplanted corn was 500 bushels. However, the averages were the interesting factors. On solid corn it was 35 bushels per acre and on interplanted 29. When fair allowance was made for the additional feed value of the interplanted crops and this was interpreted in terms of corn, the average yield was 39 bushels.

The farmers were delighted with the 8 purebred bulls and 16 purebred pigs, as well as the fertilizer and feed, awarded as premiums. They were pleased with the plans of the contest, and many of them had more feed for their livestock than ever before.

The second year of the contest saw many farmers interested in the problem of feed production. About 3,000 acres were entered, and many thousand additional acres received fertilizer and proper care. Farmers were asking their vocational teachers for information on corn production. They were talking to their neighbors, comparing methods, soils, and fertilizers, and swapping experiences. They were beginning to awaken to the possibilities of new cash crops.

Outstanding Results

The second year's results were outstanding—300 farmers on all kinds of farms, all kinds of soils over the entire county, yes, all kinds of farmers, were proving something to themselves and to the State. The highest yield on solid corn was 862 bushels and on interplanted it was 598 bushels plus an abundance of additional feed. Here again we have interesting averages. On solid corn it was 43 bushels per acre and on the interplanted it exceeded 30 bushels. On both solid and interplanted corn the average was 37.4 bushels per acre. With the additional feed value of the interplanted crops translated into terms of corn and added, the average was at least 45 bushels of corn per acre.

"Good!" someone said, "but what about the fertilizer cost of this corn?" In measuring each plot of corn a complete history was taken and the fertilizer cost determined. Since this information had nothing to do with whether or not a man won a prize, there was no reason to doubt its accuracy. When we allowed $10 per acre for land rent, labor, seed, etc., and added to this the fertilizer cost of less than $4 per acre, we found that it cost the farmers an average of 30½ cents per bushel to produce this corn. It was conservatively estimated that because of the corn contest Colquitt County farmers harvested and fed to livestock at least 500,000 bushels of corn that they would not have had were it not for the interest created by the contest.

The second year of the contest was a fairly good corn year in the county, and someone wanted to know what would happen when we had a bad corn year. This question was very effectively answered in 1941, the third year of the contest. We had a so-called "bad" corn year, but here are the answers. We did not get 862 bushels from our best 10 acres. We did get 797 bushels—but again let's look at the averages for they tell the real story. On solid corn we rolled up the impressive average of 44.7 bushels per acre and on the interplanted 35.5 bushels, or 41.7 average on all corn measured in the contest. With feed allowances of 15 bushels per acre on the interplanted corn, a grand average of 48 bushels to the acre was made. The cost for fertilizer was 8 cents per bushel, with the total cost under 30 cents per bushel.

Widespread Influence

We have conducted the Colquitt County 10-acre corn contest for 3 years. During that time approximately 8,000 acres of corn have been entered. Many times that acreage has been affected by the practices advocated in the contest. Farmers are planting their entire corn crop on a new basis. They are recognizing the value of good seedbeds, good prolific varieties of seed corn, proper and complete fertilization, and correct cultivation methods. No longer is the corn crop being neglected, no longer is it being treated as a "necessary evil just so's to have corn to feed the mule." It is being cared for just as carefully as the other cash crops on the farm.

Many changed practices are coming into use among the farmers of the county. More winter legumes are being used. Farmers are recognizing the fact that humus, a storage medium for moisture as well as plant food, is absolutely necessary. One very prominent farmer, L. C. Rodgers, told the writer last fall that he had been watching this corn contest and that at first he thought very lightly of it. After two years he had become convinced that it was a good thing (several neighbors had produced

Pile of corn at left represents Colquitt County average yield of 11 3/10 bushels per acre for the past 15 years. Pile at right represents average yield of 86 2/10 bushels per acre on best 10 acres in the county in 1940.

high yields) and he was going to put in 25 acres of Austrian winter peas and enter in 1941. The writer forgot about the conversation until a few days before closing time for the '41 contest when he walked into the office of the county agent and met this same farmer. Immediately Mr. Rodgers asked when his corn was to be measured. He volunteered this statement, "I have more corn on 25 acres than I usually make on 80." When pressed for an explanation, he further stated that he believed he had as good land as Mr. Jenkins or Mr. Watson, two of his neighbors who were getting averages of better than 50 bushels to the acre. The writer measured the corn and it averaged 55 bushels.

Here are the interesting cost facts about this corn. A good crop of Austrian winter peas was turned under, the AAA paid the cost of these. One hundred pounds of 20% superphosphate and 100 pounds of kainite were used as fertilizer. The peas supplied the nitrogen, and at a fertilizer cost of $2 per acre this farmer made more corn from 25 acres of land than he had usually made from 80 acres, and saved the cost price difference on cultivating the 25 acres vs. the 80. This same farmer has covered the county looking for all the calves he can buy to harvest his corn and his cowpeas that were grown along with the corn. This is an actual instance of our corn-livestock program functioning. More interesting stories of changed practices and gratifying results could be related.

Many of the farmers are growing corn interplanted with velvet beans, peanuts, or soybeans. They harvest and store what corn they need for feeding the work stock and for finishing feeder steers or early spring hogs and then turn their hogs and cattle into the fields to harvest the remaining crop. In most instances they have sufficient feed on the field after the corn has been gathered to give several hundred pounds live weight gain to the acre. In addition to the profit from the cattle or hogs thus fed, the farmer is returning to the soil most of the plant food consumed in producing the crop. After the livestock have cleaned the feed from the land all litter left is disked in or turned under, thus adding much needed humus for plant food and water-holding capacity.

(*Turn to page* 40)

Borax Helps Prevent Alfalfa Yellows in Tennessee

By H. E. Hendricks

Agricultural Extension Service, Knoxville, Tennessee

ALFALFA is not the most important hay crop in Tennessee from the standpoint of total acreage or tonnage produced. Korean lespedeza holds that position. Yet about 10% of the hay produced in Tennessee is alfalfa, and it is very important on those farms that grow it. They not only need the tonnage but also the quality of hay that alfalfa produces.

Outside of the market hay section of the Mississippi Delta, alfalfa is most common on dairy or general livestock farms—farms that are operated somewhat intensively and certainly more efficiently than the average, particularly from the standpoint of the economic use of the cropland.

Alfalfa is a relatively expensive hay crop to get started. To begin with, it is usually seeded on the most productive land on the farm; it must be limed, phosphated, in many cases manure or potash must be used, relatively high-priced seed bought and inoculated, and the land properly prepared. By the time the average Tennessee farmer gets an acre of alfalfa seeded, he has invested from $12 to $15 cash, besides his work.

He then hopes to get at least from 12 to 15 tons of hay off that acre during the following 4 years. In many cases the alfalfa does not last that long, neither does it produce that much hay. In the second or third year the alfalfa often seems to have a hard time surviving the hot, dry periods of late June, July, or August; it then grows slowly, the leaves turn yellow, and the summer showers seem to grow crab grass better than alfalfa.

To those of us who have been trying to increase the acreage of alfalfa, this condition has been, and still is, a serious problem. Unless it is corrected, it is certain that alfalfa production, at least in certain sections of the State, will not continue to increase to the acreage consistent with the best land use and farm management efficiency.

Diagnostic Procedure

This summer occurrence of yellows in alfalfa has been diagnosed frequently by agricultural workers, and it would be interesting to have a collection of all the causes and names ascribed to the trouble and the remedial measures recommended to correct it.

The usual procedure has been to first determine if the land itself is adapted to alfalfa production. Next came the liming history and the amount of phosphate used; then if adequate amounts of stable manure or potash were used, something else was sought. Quite frequently the adaptability of the variety was questioned. All of these things are important. Insects and disease symptoms were also noted.

Leaf hopper injury, "hopperburn," is very common in almost all alfalfa in

This paper was also published on October 28, 1941, as mimeographed Special Circular 152 of the Tennessee Agricultural Extension Service.

the State and in rainy seasons also causes yellowing and defoliation. While the two troubles are common and are sometimes quite important, they are hard to correct in a farmer's alfalfa field. Besides, neither seems to give a real answer to the yellowing and poor growth of alfalfa under the discussion here.

In 1939 the severity of this situation was brought to the attention of Director C. A. Mooers of the Tennessee Experiment Station. Then, together with Dr. W. H. MacIntire and Dr. C. D. Sherbakoff, Chemist and Pathologist, respectively, of the Tennessee Station, a limited number of test demonstrations were planned on East Tennessee farms whereby potash and borax were applied to old alfalfa stands that had formerly received limestone and phosphate applications, but which had turned yellow during the summer.

In 1940, observations of these treatments indicated that they might have merit, at least that they should be tried out on as large a number of soil and other variable conditions as was feasible.

In 1941, in order to continue these demonstrations, county agents in 21 Tennessee counties, distributed throughout the State, agreed to select test demonstrations, lay out the plots, see that the material was properly applied, and make such observations or record such information as might be requested.

One of the demonstrations in the Foothills of the Cumberland Plateau on the Eastern Highland Rim.

These test demonstrations consisted of applications of muriate of potash at the rate of 100 pounds per acre and borax at the rate of 20 pounds per acre. Each material was used both singly and in combination. The lime and phosphate requirements of the land had been met. Some of the demonstrations had also received an application of stable manure. All of the 21 counties carried out at least two of these demonstrations, and some carried out three.

Some of the demonstrations were spring seeded, and the material applied at time of seeding. Some were seeded the fall before, some were a year old, some two, and some three. Most of the material was applied in March as a top-dressing.

In 1941 Tennessee, like a large number of states in the East, experienced a very severe drought during the early part of the year. At the time of the second cutting, in early July, a number of the county agents in those counties carrying on the demonstrations contacted the writer with reports that the borax, particularly, was showing significantly beneficial results. Typical of such reports was one from D. B. Hendrix, county agricultural agent in Sevier County, who made the following report of the demonstration on the farm of Henry Marshall.

"On the quarter acre where borax was used alone, at the rate of 20 pounds per acre, the alfalfa at the second cutting averaged 4 to 6 inches taller, had a much darker green color and profuse bloom, yielded probably double that of check plots, and had very few yellow plants. On the quarter acre where both borax and muriate of potash were used, the alfalfa appeared slightly denser than either of the other plots, but not remarkably better. On the quarter acre where muriate of potash

was used alone, the plants showed some yellowing but the yield was much better than the check plot, though not as good as where the borax was used alone."

The writer saw these particular plots in late August, and even after considerable late summer rainfall, the borax-treated plots still showed marked improvement. It was particularly noticeable that very little crab grass was growing where borax had been applied, whereas, where potash alone had been applied there was a light growth of crab grass. Where no treatment other than limestone and phosphate had been made, there was very little growth at that time with the exception of crab grass.

Borax Increases Yield

Another interesting demonstration was in Williamson County in middle Tennessee. Joe D. Beasley, assistant county agent, measured the yield of the alfalfa on the farm of H. C. Jamison and reported the following:

"At the second cutting, yield per acre of check plot was .56 tons; borax alone, 1.06 tons; borax and potash, 1.21 tons; and potash alone, .75 tons."

This particular field had been seeded to alfalfa three different times in the last 30 years, and had been in alfalfa about half of the time since 1910.

From the reports of the county agricultural agents of the various counties and from personal visits to these demonstrations, it was apparent that this year the borax had little or no effect on the new or spring seedings of alfalfa made in 1941. None of the demonstrations, regardless of the age of the alfalfa, showed effects of the borax at the time of the first cutting.

On seedings a year or more old, about half of the demonstrations in the State reported yellows on the untreated portions at the time of the second cutting. About half of the demonstrations showed little or no response from borax applications at any time during the year, but in these cases the alfalfa was not affected with yellows. In only one demonstration where borax was applied the alfalfa yellows condition was not entirely corrected. It may be that an inadequate amount of borax was applied in this particular case.

The effect obtained from applications of potash seemed to be directly related to the native potash content of the soil, and more particularly to the length of time the land had been in alfalfa. Naturally, where stable manure had been applied little or no response was received from potash, neither was it expected.

It has long been known that it is necessary to lime and phosphate the land to grow alfalfa successfully in Tennessee. Recommendations on the use of potash have been associated with soil types and prior cropping systems. It seems that now the use of borax is definitely in the alfalfa production picture, although our knowledge of the use of the material on the crop in Tennessee is too meager to make specific recommendations and be sure of our ground.

From the limited experience in this State, it seems that borax applications are of value only in the prevention of alfalfa "yellows," although not all alfalfa fields turn yellow even in dry weather. It should be kept in mind also that there is one common yellowing due to the leaf hopper and another to the fungus leaf spot, neither of which could be corrected by applications of borax.

Thus far it is difficult to correlate alfalfa "yellows" with soil type, although this relationship may be found later.

It has not been determined specifically how much borax should be applied per acre, when it should be applied, or how long a given application is likely to be effective. The relationship of borax response to the life of the stand is most important and awaits future determination.

Since it is evident that a reasonably light application will do the job, and since the cost per acre of the borax is

(*Turn to page* 42)

McIntosh apple orchard 24 years old. Good covers of bluegrass or clover have always been grown. The trees have never lacked for nitrogen, phosphate, potash, and lime. Yields have been more than 500 bushels per acre for 8 years except in 1938 when the crop was killed by spring frost.

Some Newer Ideas on Orchard Fertility

By F. N. Fagan

Pennsylvania State College, State College, Pennsylvania

Editor's Note: The following is the text of an address delivered at the picnic given by Senator Harry F. Byrd at his Rosemont Orchard near Berryville, Virginia, on August 30, 1941. Senator Byrd is one of Virginia's largest orchard operators and for many years has invited more than 1,000 people interested in the production of more and better fruit to be his guests, partake of a delicious dinner, and listen to good speeches and discussions on orchard problems.

AS I sit here thinking over the subject of orchard fertility that Senator Byrd asked me to discuss with his friends this year, my thoughts turn to the several times I have been a guest at the Byrd picnic. Just what is it that brings orchard folks to this picnic year after year? Many guests have driven miles to be here. The thing which brings us is something big, at least I think it is. It is not just for the good dinner Senator Byrd gives us. Most of you could have bought a good meal right at home for the price of the gasoline you used to drive to this orchard. Some people may think it is the apple buyer contacts made here. Some people may say it is politics. I for one will say that I never felt it was politics, but we orchard folks as well as all farm folks can thank our lucky stars that we have Harry F. Byrd, the orchardist, in the U. S. Congress. I wish we had some more of you in Congress.

I truly believe that what brings orchard folks here from the four corners of Virginia, from West Virginia, Mary-

land, Delaware, Pennsylvania, and even from more distant states, is the enthusiasm, the interest, yes, the love for a real industry, the fruit industry, an industry that has weathered storms of insects, diseases, and hail; an industry that has in the main fought its own battles; an industry that has had its ups and downs, but is still an industry furnishing a living for thousands of people.

The farm and orchard folks east of the Allegheny Mountains can be proud of their industry, for most of their farms are a better place to live today than they were 50 or 75 years, yes, 100 years ago, and many of their acres are producing food in larger amounts than they did 75 years ago. I am glad I am connected with such an industry.

Let me say right now that I feel highly honored to have been asked by Orchardist Harry Byrd to be a speaker at his picnic. I feel highly honored to have him ask me to discuss the fertility problem, for after all, the fertility of the soil is the all-important part of any branch of a successful agriculture.

The food in the soil for the plant or tree is the main key to all crop problems. We may trim our trees and spray them against pests, but if the soil does not contain the right food and in large enough amounts, and is not able to hold moisture, all such work is likely to be lost. We must have enough of the elements of plant food, which by the way includes moisture, in the soil or we can not expect our trees to produce yields of fruit large enough to leave a profit for our labor at harvest time. A high yield of 900 packed bushels of apples per acre has about the same acre production cost as a low yield of 200 packed bushels per acre. A 600- to 900-bushel yield can not be had without plenty of plant food and moisture in the soil.

Yes, I know some of you are thinking "plant food," be it chemical fertilizer or manure, costs too much money. I wish to drive home to you orchard and farm folks that we should hand out a word of praise, right now, to the fertilizer, chemical, and lime industries. They are giving us cheaper fertilizers, spray chemicals, and lime products than ever before, and all of these help to cut our cost of production. Yes, these industries need a word of praise for, in most cases, they are trying to sell us the right materials instead of just tonnage. They know the orchard man and farmer must be successful or he will not be a customer year after year.

Severe potash deficiency on the peach. The two shoots at the right are badly injured from lack of potash.

The fact that we have farm acres that have been under the plow and producing paying crops for 50, 75, and 100 years shows clearly that the U. S. farmer knows his industry, his soil, his Old Mother Nature. Sure we have farmers that get into financial trouble. If I remember correctly, a lot of banks, manufacturing plants, and retail stores also had their financial troubles during the last 12 or 14 years, and just as high a percentage as in the farming game.

Yes, the U. S. farmer knows his industry, knows a lot about his soil fertility and crop production. No group

of people know their business better than the farmer knows his business. The past 16 years of American agriculture proves this fact.

Many years ago by Government legislation to help agriculture, a noble experiment, the Farm Board Bill was enacted, and since that time many other noble legislative bills have been enacted to help agriculture. If I am not mistaken, there was nothing really more wrong with agriculture when the Farm Board Bill was enacted than there were

Severe potash deficiency in the apple shoot at the right shows the short slender growth and burned leaves characteristic of severe potash shortage.

things wrong with a lot of other industries. If I remember correctly, one Virginia Senator, Mr. Carter Glass, said then that the act would not help agriculture, but that it might keep some tobacco, cotton, and grain banks, that had been doing a poor job of banking by loaning too much money on warehouse receipts, from failing. If I remember correctly, Mr. Glass never liked the change that was made in the National Bank Law some years ago. During the last 16 years there has been a lot of world "underconsumption" of food and not world "overproduction" of food.

The noble experiments to control agricultural production (tobacco, cotton, wheat, etc.) by reducing acreage and paying the farmer to do so have not reduced production. We still hear a lot of talk about surpluses, even to the tune of a 49¢ tax on a bushel of wheat if Mr. Farmer has produced more than his ratio, whether he has or has not signed on the dotted line. He'll just grow rye, barley, or oats next year. He knows his livestock will eat chops made from grain other than wheat; he knows his livestock will bed down on good straw even if it is not wheat straw; he knows rye, barley, and oat straw, through the barn and feed lot, will make just as good manure.

This same farmer will be buying at the same time his share and maybe more than his share of Defense Savings Stamps and Bonds, and if war comes, we can depend on him to do his part as he did in World War I.

The independent land-owning or good U. S. tenant farmer knows just too much about his soil's producing power for "The Economic Planners" to cope with. He may be a gambler, but if he is, I am sure he knows his cards. Beat him at his game if you can.

Few of you need to be told anything about feeding your trees their nitrogen food, such as from nitrate of soda, cyanamid, sulphate of ammonia, etc. Some of you do not use enough, however. How many of you have been thinking about the following foods for your orchards: phosphate, potash, calcium (lime)? About the organic and water-holding power of your orchard soils? I am sure not enough thought has been given by you, as well as by experiment station workers, to these items of fertility. How many of you would grow wheat without at least the use of phosphate fertilizer or a complete fertilizer such as a 2-12-4, a 2-8-8, or a 4-12-4? Not many of you. How

many of you would grow a crop of corn without some fertilizer? Many of you would use some phosphate even if the corn was being planted on land where you had plowed down a clover, alfalfa, or hay land sod to which you had applied that fine fertilizer—manure. Yes, we orchard folks have neglected using phosphate, potash, lime, manure, and cover crops.

It seems funny to me now why we thought we could get along without them. We knew we needed them for farm crops, and trees grow just the same as cotton, corn, tobacco, wheat, and the truck crops. The truck gardener has always been a great user of manure and other fertilizers as well as nitrogen, and we can learn a lot from him if we will. We orchard folks used to practice the fine, clean cultivation system in our orchards. By this method, we unlocked all the natural nitrogen in the soil. The trees grew fast during their young years, then they did not do so well. We then fed nitrogen, in soda and sulphate of ammonia. The trees responded and we were satisfied, but this clean cultivation year after year at last caused all the natural organic material to burn out of the soil. Our good little friends, the soil bacteria, died because we had destroyed their homes. They could not work for us, could not even help with the phosphate and potash liberation. Legumes would not grow, and nitrogen bacteria could not put nitrogen back into the soil.

I know but one thing about soil bacteria, and that is, they are the orchard man's friends. With clean cultivation year after year we did all in our power to keep nature from working for us. We applied nitrogen fertilizer, used it up, and never figured we were also losing our phosphate, potash, and calcium by this method of orchard soil culture. Surface wash took its toll of these plant foods. We cannot have soil bacteria working for us in a clay bank. Good bricks could have been made from the soil in many an orchard by sifting out the stone and burning the clay in the normal brick-making way. We wanted to grow a big tree fast—cultivation would do it.

The fruit tree nurseryman could have told us what we would do to our soil. He was a clean culture man to the Nth degree. In many cases of tree growing he cultivated his land clean for three summers before he dug his trees, but he never put trees right back on the same land. He put his land back to a rotation of farm crops with manure or back to sods of grasses, clovers, or some other legumes. The orchard fertilizer problem is interlaced with the general system of orchard soil management, be it cultivation given or not given, cover crops grown or not grown, stock manure used or not used, sods grown or not grown. Let me read to you a few statements about orchard fertility. These statements come from several different sources and point to the use of complete fertilizers.

Annual Fertilization Beneficial

Turning to recent published work on orchard fertilization we find Professors Blake, Nightingale, and Davidson stating in New Jersey Agricultural Experiment Station Bulletin 626 as follows:

"Some orchard soils may be so well supplied with all the common nutrients that they will not show a beneficial response to applications of fertilizers. Other soils may be deficient in one or two nutrients but be well supplied with the remaining elements. In general, however, orchards planted upon Coastal Plain soils will be benefited by annual applications of a complete fertilizer.

"Orchard soils which are obviously deficient in nutrients and where neither sod, cover crops, weeds, nor trees are making enough growth should receive a complete fertilizer somewhat higher in nitrogen, such as 5-10-5 . . . If the trees and soil are not actually deficient in nutrients, this treatment is definitely unwise.

"Calcium should be regarded as a

(*Turn to page* 42)

Fig. 1. White beans on an experimental field near Ovid, Michigan. The two rows at the left received potash; the plants were green and thrifty. The next two rows received phosphate; the plants were small and the leaves were yellow. The next four rows received a complete fertilizer; the plants were large and of a normal green color.

Plant Symptoms Show Need for Potash

By R. L. Cook

Michigan State College, East Lansing, Michigan

THERE are several ways of determining whether or not a soil is deficient in nutrients for any certain crop or group of crops. The oldest method now in use is that of field plat experiments. This method is probably the most reliable, but it is also the slowest and most expensive method now being used.

Soil testing, as a method of determining the level of easily available nutrients in soils, has become rather common during recent years. Such tests are very helpful when they are properly performed and the results are correctly interpreted. It is always impossible, however, to be certain that "availability" as determined by a chemical test coincides with "availability" to the plant under consideration.

Of still more recent origin than the soil tests are tests made on green plant tissue. The logic behind the testing of plant tissue is simple. If the plant can obtain sufficient of the nutrient from the soil, it will show up in the test, and if it cannot obtain the nutrient in adequate quantity, the supply of the nutrient in an available form must be limited. In other words, the plant itself becomes a means of measuring availability. While plant-tissue tests may not be sufficient in themselves, the combining of tissue testing with soil

testing should lead to more reliable conclusions than may be drawn solely from soil-testing results.

A fourth and still newer means of attack on the problem of nutrient availability is that of plant symptoms—using the appearance of the plant as an indication of the supply of nutrients in the medium which supports the plant. Underfed plants often develop abnormally in much the same manner as do animals

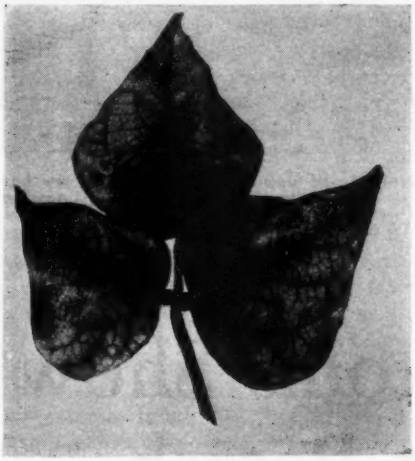


Fig. 2. A white bean leaf showing characteristic symptom of potash starvation. The ends and edges of the leaflets turn yellow first, then the yellowing works toward the center and base until the entire leaflet is yellow.

when certain essential ingredients are not included in their ration.

The use of plant symptoms as a means of diagnosis should become very popular because no expensive equipment is needed and it is not necessary to wait for the results from long, tedious experiments or chemical determinations. Any farmer can make use of this valuable tool by becoming acquainted with the symptom in which he is interested. The following results of some potash studies, made during the past two years, are a good illustration of the methods used in studying symptoms and of the value of symptoms as aids in making fertilizer recommendations.

Greenhouse pot culture and field plat experiments furnish excellent opportunities for studying nutrient deficiency symptoms. While some ideas may be obtained from printed descriptions and black and white photographs, it is well to actually observe plants exhibiting known deficiency symptoms. Colored slides are coming into wide use as a means of recording symptoms after it is no longer possible to save the specimens.

Field plat experiments have led to some interesting observations. In an experiment located on Miami loam soil near Ovid, Michigan, white beans were fertilized with nitrogen, phosphate, and potash fertilizers separately and in all combinations. The fertilizer was applied in a band one-half inch out from and one and three-fourths inches below the seed at the time of planting on June 9, 1939. By July 21 the differences in growth as a result of the fertilizer applications were very marked. As shown in Fig. 1, the plants which had received phosphate alone were small and the leaves were characteristically yellow. This is indicated by their light color in the photograph. A close-up of one of the leaves, Fig. 2, shows that the yellowing starts near the edges and ends of the leaflets. It then works in toward the centers until finally the entire leaf turns yellow. Death follows and the leaf dries up.

The plants which received no fertilizer and those which received nitrogen alone were less yellow than those which received phosphate alone or phosphate and nitrogen. Plants which received potash, as shown in Fig. 1, were larger than those treated with phosphate and were of a normal green color. The largest plants in the field were those which received either both phosphate and potash or all three plant nutrients, nitrogen, phosphate, and potash.

While it seemed certain from the appearance of the plants on the variously fertilized rows that the yellow color was a symptom of potash starvation, it was decided to check further on this by means of potash side-dressings. It happened that a portion of the field at one side of the experimental area had been

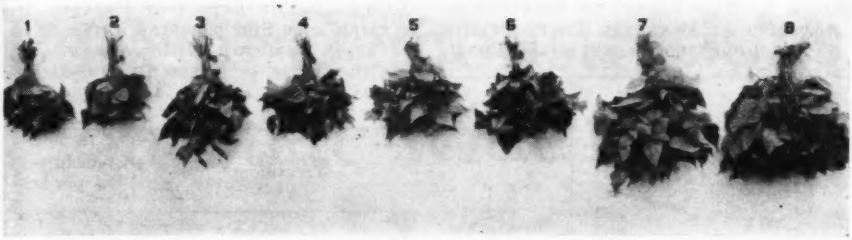


Fig. 3. These bunches of beans taken from the field on July 21 show that a combination of phosphate and potash was necessary. (1) No fertilizer, (2) 4-0-0, (3) 0-0-8, (4) 4-0-8, (5) 0-16-0, (6) 4-16-0, (7) 0-16-8, (8) 4-16-8.

uniformly treated with superphosphate at planting time. On July 22 one-third of the rows on this area were side-dressed with 100 pounds of muriate of potash per acre, one-third with 50 pounds per acre, and one-third were left without treatment. Within three weeks after this treatment the rows which had received the potash had reassumed their normal green color, and the plants were much larger than those in the rows which had not received potash and had remained yellow.

The bunches of beans shown in Fig. 3, photographed on July 21, show the comparative sizes of the plants on the plats which were variously treated at planting time. By August 25 it was evident that very few pods were setting on the plants which did not receive potash. Some typical plants are shown in Fig 4. There were only 2 pods on the plant fertilized with phosphate, while there were 9 pods on the plant treated with potash and 14 on the plant which received a combination of phosphate and potash.

Potash also hastened maturity of the beans in this experiment. As indicated by the bunches of plants shown in Fig. 5, the beans on all plats which had received potash were well matured, while those on the other plats still retained their leaves and the pods were immature.

The yields of these plats show that potash not only produced a healthy appearance, but also increased the yields (Table 1). The data show that plats treated with phosphate yielded but slightly more than did the untreated plats, while those which received potash produced yields which averaged exactly twice as high as those from the unfertilized plats. While phosphate alone did not appreciably increase the yields, the nutrient caused a significant in-

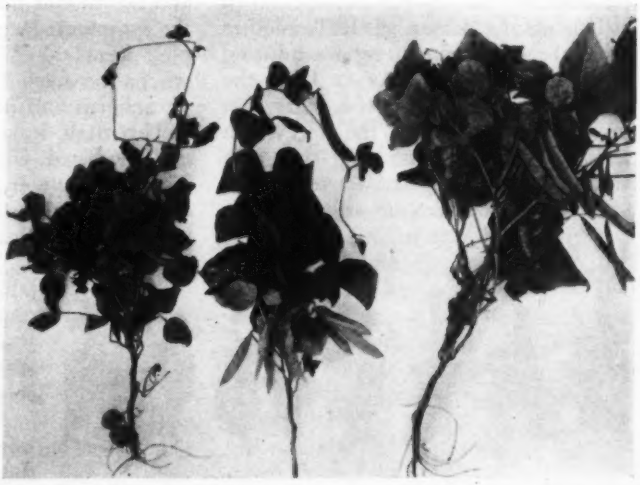


Fig. 4. Potash was necessary for pod setting on these white beans. The left plant received only phosphate and set only 2 pods. The center plant received only potash but set 9 pods. The right plant received both phosphate and potash and produced 14 pods.

TABLE 1.—THE EFFECT OF FERTILIZERS, APPLIED AT PLANTING TIME, ON THE YIELDS OF FIELD BEANS. MIAMI LOAM.

Fertilizer*	Rate	Yield—Bu. per acre
No fertilizer		6.1
4– 0–0	300	6.2
0–16–0	300	7.6
4–16–0	300	6.5
0– 0–8	300	12.2
4– 0–8	300	10.5
0–16–8	300	16.4
4–16–8	300	14.9

* Applied in a band one-half inch out from and one and three-fourths inches below the seed.

TABLE 2.—THE EFFECT OF POTASH, APPLIED AS A SIDE-DRESSING AFTER STARVATION SYMPTOMS HAD APPEARED, ON THE YIELDS OF FIELD BEANS. MIAMI LOAM.

Treatment*	Yield—Bu. per acre
Muriate of potash 100 lb. per acre	19.4
Muriate of potash 50 lb. per acre	17.8
No potash	9.7

* 240 pounds 0-20-0 per acre applied at planting time. Treatments were replicated 8 times.

crease in yield when used in combination with potash. Nitrogen, either alone or in combination with phosphate and potash, did not cause increases in yields.

The data reported in Table 2 show that on the plats where potash was applied as a side-dressing after starvation symptoms had appeared the yields were increased from 9.7 to 17.8 and 19.4 bushels respectively as a result of 50- and 100-pound applications of potash. The increase in yield caused by the 100-pound over the 50-pound application was not large enough to be significant.

During the season of 1940 another white bean experiment was conducted on the Ovid farm. As in 1939, the yellow symptoms of potash starvation appeared rather early on the plats which did not receive potash. At the same time, similar symptoms appeared on soybeans grown on an adjoining experimental field and, as in the case of white beans, the symptoms were not present on plants which had been treated with potash.

It was decided at this time to make a survey of some of the white bean fields to see if these symptoms were confined to the locality of Ovid or were scattered well over the State. Accordingly, during the latter part of July a large number of white bean fields were visited and signs of potash starvation were found in many fields throughout the bean-growing area. Leaf samples for analysis were taken from 40 fields, and record was made of the severity of the symptoms in each field. The samples were taken into the laboratory where the fresh tissue was tested for phosphorus and potassium.

The fresh leaves were finely sliced and extracted with weak acetic acid. The potassium in the extract was precipitated with sodium cobalti-nitrite. Readings were based on the amount of precipitate which formed. Phosphorus in the extract was determined by the ammonium molybdate colorimetric method.

A very good correlation was found between the presence of symptoms and the potassium content of the fresh tis-

(*Turn to page* 36)

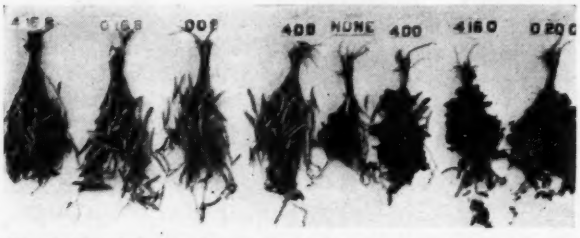


Fig. 5. Potash hastened maturity of these beans. The four bunches at the left received potash; the leaves had dried up and the pods were well matured. The other four bunches were from rows which did not receive potash; they were not mature at harvest time.

Potash Demonstrations on State-wide Basis

By R. W. Shoffner

Agricultural Extension Service, Raleigh, North Carolina

NINETY-FOUR farms in 20 counties in North Carolina were selected in the spring of 1941 to demonstrate the value of potash in a well-balanced and properly managed farm program. The demonstrations are being supervised by the North Carolina State College Agricultural Extension Service. Demonstrating the value of fertilizer materials on an entire farm unit basis is relatively new and is a much larger and more complicated task than carrying out an ordinary test where potash or other fertilizer materials are applied to part of the crop and left off a small check plot.

The real test for any farming practice is the effect it will have upon the farm income and family living over a period of years. With this fact clearly in mind, we are attempting to throw new light on various farming practices by showing how they fit into the whole farming picture and by measuring the effect upon the farm income as a whole over a period of years. We are not attempting to do research work, but are trying to demonstrate proper fertilizing practices, rotation of crops, and many other good farming practices along with good sound farm management.

We expect not only to correct potash deficiency on these farms and to demonstrate to the public the value of using potash and other fertilizer materials where they are needed, but also to demonstrate numerous other good farming practices and to show how all of these practices fit together to make a complete farming unit.

The Farm Management and the Agronomy Departments at State College selected 20 counties to carry out this work. These counties represent all of the different types of farming areas in North Carolina. The eastern part of the State is represented by Duplin, Jones, Bladen, Wayne, Cumberland, Perquimans, Edgecombe, Pitt, Wilson, Hyde, and Bertie counties. The Piedmont area is represented by Alamance, Caswell, Surry, Union, Cabarrus, Davidson, and Davie counties; while the mountain area is represented by Henderson and Buncombe counties. As a general rule there are five farms per county. The individual farms within each county were selected by county committees along with the county agent after each farmer had submitted an application to become a demonstration farmer. In the selection of these farms, special attention was given to soil type, size, and type of farming.

State Department Cooperates

The Farm Management Department is organizing and planning the work. Fertilizer recommendations are being furnished by the Agronomy Department, while the extension agronomist has assisted in working out rotations for most of the farms. Other State College specialists are furnishing information and services as they are needed. The State Department of Agriculture has run more than 1,000 soil samples which came from these farms during the past year.

The farmers cooperating in this work have furnished certain basic information which gives a good cross-

section of these farms. This information can be used from time to time in measuring progress on the farms.

The following discussion is based on the summary of information tabulated for the 94 farm management demonstrations using potash. All 94 farms were used to obtain an average for the State, while averages for the eastern counties represent 51 farms; for the Piedmont, 33 farms; and for the mountain counties, 10 farms. In addition to giving the State average, in some cases averages for the three sections have been compared.

What Averages Disclosed

The average demonstration farm contains 143 acres of total farm land, of which 63 acres are cropland and 9 acres open pasture. Total farm land averaged 159 acres in the eastern, 139 acres in Piedmont, and 75 acres in the mountain area. The cropland in the eastern averaged 68 acres per farm, while in the mountain area it averaged only 33 acres. The reverse is true for open pasture as shown by 18 acres per farm in the mountain as compared with only 3 acres in the eastern group. The Piedmont is about midway between the other groups for both cropland and pasture.

The average operator in the Piedmont and eastern groups had been farming 26 years and was 46 years old. In the mountain section the farmers were 15 to 20 years older and had been farming about 10 years longer. The average operator had spent 10 years of his life in school. There was an average of 9 people per farm for the 94 farms and 6 of these were above ten years of age.

The information as to the farm and home revealed that two-thirds of the homes had electricity, and approximately one-third had electric refrigeration. About one-third of the farm homes had running water for the farms as a whole, while slightly more than half of the farms studied in the Piedmont had running water. Of the 94 farms studied, all except 7 had radios. About half of the 94 farms were keeping farm records before this program started, and four-fifths were taking a daily paper. All but one farm were taking some kind of farm paper.

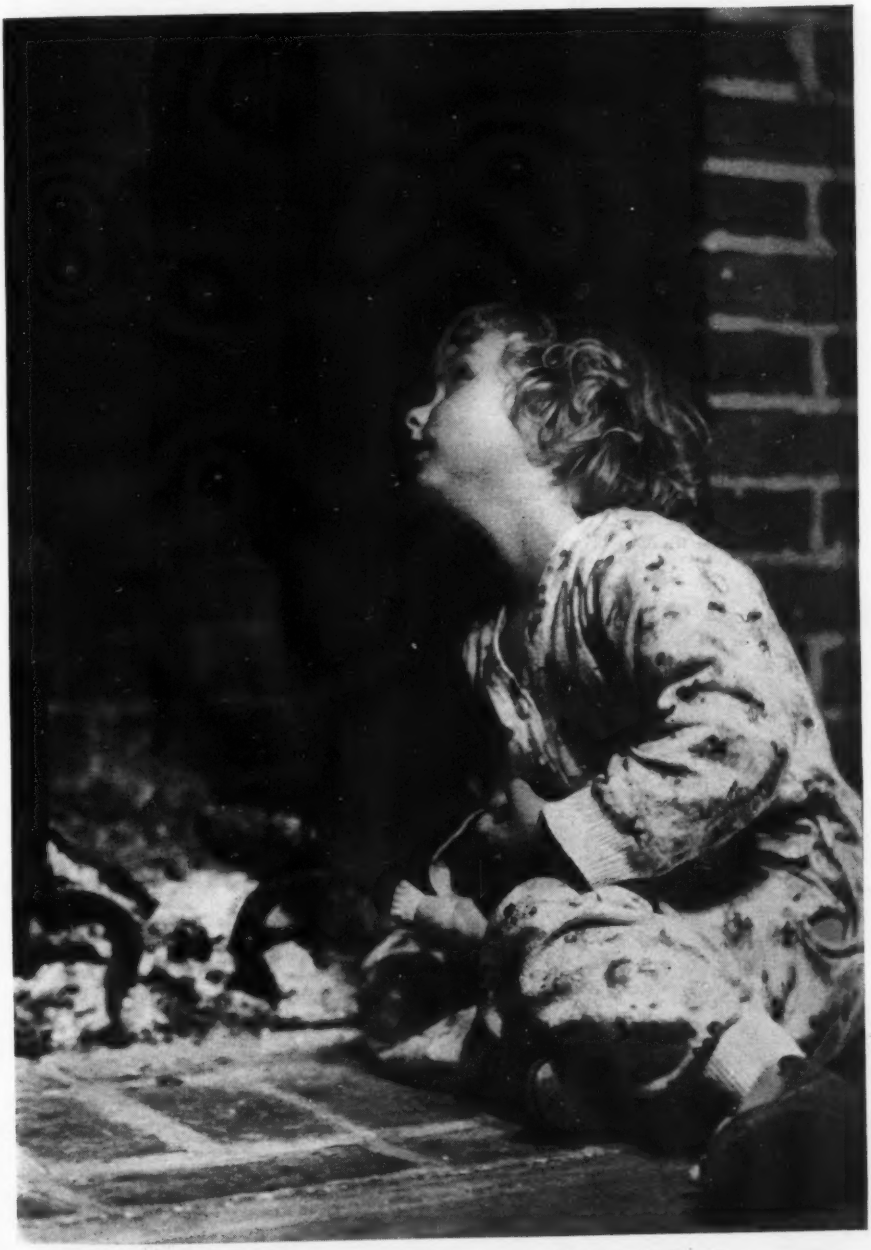
All farmers in the mountain area had a year-round garden and fruit. Piedmont farms had gardens and in most cases their fruit supply. Most eastern farmers had gardens, but only two-thirds had sufficient fruit to supply the farm needs. Only 7 farmers out of the 94 reported insufficient milk supply for the farm; 5 of these were in the eastern area and the other 2 in the mountain area.

Forty-five of the 94 farms were mortgaged, and less than 35% of the 94 had a source of outside income.

Yields of crops reveal that the eastern group had an average of 6.3 acres of cotton per farm with an average yield of 542.5 pounds per acre. The Piedmont had an average of 4.5 acres with an average yield of 491.1 pounds per acre. The tobacco acreage averaged 5.9 in the eastern group, with 1,007.6 pounds per acre. The Piedmont averaged 2.7 acres per farm with 810.5 pounds per acre. There was an average of 19.4 acres of corn for the 94 farms with a yield of 28.7 bushels per acre. The eastern group had an average of 25.5 acres and a yield of 29.5 bushels; Piedmont an average of 12.3 acres with a yield of 24.9 bushels; and the mountain group 11.2 acres with a yield of 32.5 bushels per acre. There was an average of 3.6 acres of wheat for the 94 farms with an average yield per acre of 18.3 bushels. Oats averaged 3.3 acres with a yield of 31.9 bushels. Barley was reported only in the Piedmont and with an average yield of 37.3 bushels per acre. Considerably more lespedeza was grown on farms in the Piedmont than in other sections. More pasture was found in the mountain area, while a small amount was found in the eastern. Sixteen farms in the eastern section had no pasture at all, while a few farms in the Piedmont reported no pasture.

(*Turn to page* 39)

PICTORIAL



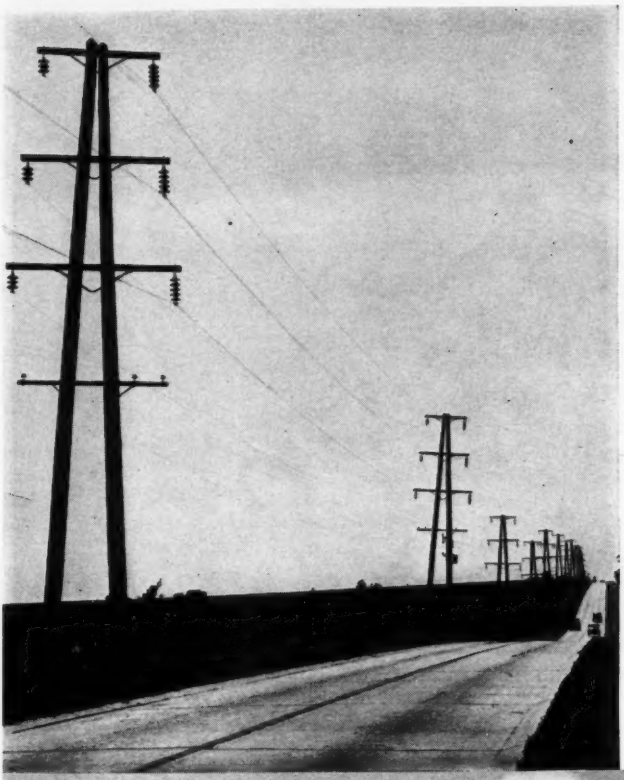
"IN HOPES THAT ST. NICHOLAS SOON WOULD BE THERE."

Above: Mrs. Ottie Leitch, LaOtto, Indiana, won sweepstakes with her entry of Sweet Spanish onions at the Northern Indiana Muck Crops Show.

Below: The Jachim Brothers of Wheatfield, with a yield of 639.79 bushels of potatoes per acre, are 1941 Indiana Potato and Muck Crops Champions.

Above: Floyd Wise (with trophy), 1941 National Corn Husking Champion, and Leland Klein, runner-up. Wise husked 45.37 bushels and Klein 45.21 bushels.

Below: Governor Green of Illinois helps out at the 1941 Corn Husking Contest. Both winner and runner-up this year are from Illinois.



Left: This power line and highway near Platsmouth, Nebraska, are typical of the conveniences enjoyed by many rural areas.

Below: A trainload of molasses on the way to an alcohol plant. This is only one of the many uses to which this product is put.

The Editors Talk

Looking Backward

When pausing to consider the events of the past year, in the light of what has happened in other countries, Americans must admit that we have been very fortunate. We have enjoyed good harvests with record-breaking agricultural production. We have plenty of food and apparently will continue to have enough. According to the Secretary of Agriculture, we might distribute what we have more evenly, but there is no doubt that Americans are the best fed people in the world.

During 1941 industrial activity experienced a greater advance than in any other year on record. Most industries are now operating in high gear at near capacity with total output substantially above previous peak years. We have made vast strides toward demonstrating to ourselves and to the world that the United States can produce guns and butter at the same time. In Europe it was a choice of guns over butter.

From the farmer's viewpoint, 1941 got off to a rather sluggish start. Most of the improvement in farm prices has occurred since the second quarter. Beginning in March farm prices started an upward movement that reached almost inflationary proportions by July. Prices continued sharply upward until September when they leveled off. This advance resulted in the most favorable balance between prices received and prices paid by farmers that has existed since 1920. In September the ratio between farm prices and prices paid by farmers was 101% of the 1910-14 average. It should be noted, however, that due to the advance in prices for most of the products that farmers had to buy, it is necessary for farm prices to be well above the 1910-14 levels in order for farmers to be on a comparable basis with the 1910-14 period.

Farmers enjoyed a combination of two very favorable circumstances—expanding production and rising prices. Production of many agricultural commodities in 1941 has been the highest ever recorded. Total production of all farm products is about 2% above 1940 and 12% above the 1924-29 average. High prices and expanding production resulted in a farm income of about 11 billion dollars, 22% above the 9 billion received in 1940.

Although farm prices as a whole attained parity during 1941 for the first time in 21 years, not all producers have enjoyed the same degree of price improvement. Prices of wheat, corn, and most feed crops are still well below parity. The level of 101% of parity attained in September was largely the result of relatively high prices received for livestock and livestock products, although cotton producers were receiving almost parity and the tobacco producers well above parity.

The year witnessed a change in emphasis in our national farm program and a new test of its adaptability to changing conditions. In September the Secretary of Agriculture announced the inauguration of a new program calling upon American farmers to adjust production for National Defense. This is the first

time in the history of the United States that production goals for all essential farm commodities have been established.

With the development of the present crisis, American agriculture is going to be called upon for even greater efforts than had been contemplated only a month ago. It is encouraging for all of us to know that these demands are coming at a time when the farm plant is in a splendid condition to meet them. The most serious deterring factor at the present time is scarcity of labor. It appears that the increase in production will have to be accomplished with fewer farm workers. There was never a time when it was more important for farmers to follow the most efficient methods of production, utilizing to the fullest farm management practices which will result in maximum production with minimum labor.

The importance of fertilizers in such a program is self-evident. In this connection it is significant to note that according to all available related information, 1941 established a new record in total plant-food consumption in the United States. With the improvement in farm purchasing power and a better ratio between farm prices and prices paid by farmers, fertilizer use, which has been profitable in the past, promises to be even more profitable in the immediate future.

Better Fruit

World conditions have moved so fast during the past year and have commanded so much of our attention that it is difficult to realize some of the changes in trends in our agriculture. America is entering a new era of nutrition—an era where balanced diets with an abundance of fruits and vegetables are being stressed. The Government has indicated its goal of doubling the consumption of these essential foods. The Nation-wide campaign to achieve this goal should have a most stimulating influence on demand.

Fruit growers are being urged to grow more and better fruit. They are being asked to take better care of their trees and to see that all fruit is grown and marketed so that this valuable source of health and energy will reach the largest possible number of people. Important as may be fruit for balancing the diet of man, important also is the balancing of the plant-food diet of the trees upon which the fruit is grown.

The official viewpoint on orchard fertilization has been through a number of cycles. In the beginning orchards were treated like an ordinary farm crop. Manure and complete fertilizers were recommended and used. This was followed by the so-called nitrogen era. While no one questions the value or importance of nitrogen in orchard fertilization, its exclusive use results in the depletion of the reserves of other essential plant foods. Eventually a state of unbalanced nutrition develops and is reflected in poor wood growth, declining yields, inferior keeping and shipping qualities, and the appearance of such physiological disorders as fruit pit, water-core, drought spot, and die-back.

In this issue of the magazine we are pleased to present to our readers F. N. Fagan's talk before an important gathering of orchardists. In this talk, Mr. Fagan brings ideas on orchard management up to date.

To Our Readers: Christmas Greetings and Best Wishes for the New Year

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

¶ One of the oldest continuous fertilizer experiments on vegetables has been summarized by John Bushnell in Ohio Agricultural Experiment Station Bulletin 622, "Fertilizers for Early Cabbage, Tomatoes, Cucumbers, and Sweet Corn." The work was conducted on river terrace soil characteristic of southern Ohio where intensive vegetable farming is practised.

During the early years of this experiment there was little response to potash by the vegetables growing on this soil, but in the past eight years very marked responses have been obtained on all crops where large amounts of manure were not used. Nitrogen was particularly effective on cabbage, moderately effective on tomatoes and cucumbers, and less effective on sweet corn. Phosphorus was not particularly effective on most of the crops, a rather unusual condition explained on the basis of large residual supplies of phosphate having been built up in these soils by past treatments. Soil tests on other farms in the vicinity, however, also showed rather high phosphorus supplies in the soil, with a surprisingly large amount of water-soluble phosphorus present, indicating that there is a soil condition which is particularly favorable to supplying available phosphorus in these soils. With applications of eight tons or more of manure each year benefits from fertilization were much less than when no manure was applied, although even the generous applications given did not fully take care of the nitrogen and phosphate requirements in all cases.

The bulletin also compares results of several methods for testing soils for their available phosphate and potash, compares the removal of nutrients by the harvested portion of crop with the amounts recommended to be applied, and gives possible modifications of recommendations in line with results of soil tests.

¶ In the nutrition of plants the balance among the various nutrients, as well as the total quantity, are important factors in the health and vigor of the plant. An interesting but technical discussion of this is given by W. Thomas and W. B. Mack in Pennsylvania Agricultural Experiment Station Bulletin 405, entitled "A Foliar Diagnosis Study of the Nutrition of Greenhouse Tomatoes in Relation to the Incidence of a Disease." When growing tomatoes with various fertilizer treatments in a greenhouse, some of the plants became affected with a fusarium disease, so the leaves were analyzed to see what relationship, if any, existed between disease incidence and the chemical composition of the leaf with respect to nitrogen, phosphoric acid, potash, calcium, and magnesium. In making the analyses, leaves from apparently healthy, slightly diseased, and severely diseased plants were taken. Yield data are given which show that the plants receiving the high fertilization gave the highest yield, followed by the phosphate and potash treatment, with a big drop for phosphate, potash, and high nitrogen treatment and a slightly greater drop for the nitrogen and phosphate treatment.

The analytical data were calculated to a milligram equivalent basis and plotted

on two sets of triangles. One triangle consisted of the so-called plastic elements, nitrogen, phosphoric acid, and potash; and the other triangle the bases, lime, magnesia, and potash. There was a distinct tendency for the leaves of the diseased plants to be relatively lower in potash and in some cases high in nitrogen and in others high in phosphate. In one case the badly diseased plants tended to be relatively low in calcium, but usually the relationship was more marked in the so-called plastic elements. In addition to the equilibrium among the nutrients, the total quantity of nutrients was also compared to disease incidence. It was found that diseased plants had less nutrients in them than the healthy plants. The authors draw the conclusion that the incidence of the disease appeared to be closely associated with disturbances in the nutritional balance and apparently also the intensity of nutrition of the plant.

"Administration of California Laws Relating to Fertilizing Materials," St. Dept. of Agr., Sacramento, Calif., Rep. from The Bulletin, Vol. XXX, No. 3, July, Aug., Sept. 1941, Alvin J. Cox.

"Amendments to Fertilizing Materials Article of Agricultural Code," St. Dept. of Agr., Sacramento, Calif., Bu. Chem. Anns. FM-32, Oct. 31, 1941.

"Fertilizer, Feed, and Seed Report, January-June 1941," St. Bd. of Agr., Dover, Del., Quarterly Bul., Vol. 31, No. 2.

"Commercial Fertilizers 1941—Analysis of Official Samples and Tonnage Sold," St. Bd. of Agr., Topeka, Kans., Paul Ijams.

"Comparison of Fertilizer Ratios for Tomatoes, 1941," N. Y. Agr. Exp. Sta., Geneva, N. Y., C. B. Sayre.

"Fertilizer Placement Experiments with Tomatoes, 1941," N. Y. Agr. Exp. Sta., Geneva, N. Y., C. B. Sayre.

"Borax Helps Prevent Alfalfa Yellows in Tennessee," Agr. Ext. Serv., Knoxville, Tenn., Sp. Cir. 152, Oct. 28, 1941, H. E. Hendricks.

Soils

¶ A revision of the excellent bulletin entitled "Sandy Soils" has been made by the original authors, G. M. Grantham and C. E. Millar. This publication is issued as Special Bulletin 248 of the Michigan Agricultural Experiment Station and brings up to date information and recommendations regarding the management and fertilization of sandy soils. While the bulletin is written primarily for Michigan conditions, the principles set forth in it are applicable to light soils in the entire northern Corn Belt.

It is brought out that, owing to the problem of moisture supply, very light and sandy soils offer particularly difficult problems if they are to be successfully farmed. In most cases it is advisable to return such land to forests or devote it to uses other than farming.

The importance of maintaining and if possible building up organic matter in sandy soils is emphasized since this is the best way to correct some of the natural deficiencies inherent in them, particularly with reference to moisture supply and retentiveness of nutrients. Rotations in which sods are turned under frequently and the growing of cover and green manure crops in addition to use of manure offer the best ways of improving organic matter in the soil. It is emphasized that in successfully growing green manure crops a certain amount of fertility in the soil and the proper degree of acidity are required. For this reason the use of lime and fertilizer should not be neglected. The use of lime is also important in connection with growing many other crops in the rotation. In order to enable the grower to apply lime with intelligence, it is suggested that the soil be tested every two or three years to determine how much lime, if any, need be used.

Fertilizers for crops growing on sandy soils should be adapted to the peculiarities of the soil and the particular requirements of the crop being grown. Nitrogen, phosphoric acid, and potash usually are required, with particular emphasis placed on the nitrogen and potash. Every effort should be made to grow as much nitrogen as possible by frequently turning under legume sods and green manures. Large nitrogen fertilizer applications at one time are to be avoided since the soils have a low retentive capacity. When large

amounts of nitrogen are needed, they should be applied in several applications. Sandy soils are usually naturally low in potash and for that reason the fertilizers should be relatively higher in this nutrient than are fertilizers used on the heavier soil types. The phosphate in the fertilizer should usually be about the same or slightly less than applied on heavy soils.

For fall-sown small grains 2-12-6, 2-16-8, or 3-12-12 are recommended with application of a nitrogen top-dresser in the spring. For fertilizing alfalfa and clover, analyses such as 0-12-12, 0-20-20, and 0-8-24 are recommended. These should be used before planting the crop, and on stands more than 2 years old a top-dressing of a similar fertilizer should be applied after the first cutting. The rate of application in all cases should be around 300 pounds per acre. Space prevents giving further details on the great amount of practical and useful information and recommendations for additional crops commonly grown on sandy soils given in this bulletin.

"Soil-building Practices in the 1941 AAA Program as They Apply to Iowa," Agr. Ext. Serv., Ames, Iowa, Pamph. 4, Mar. 1941.

"Natural Land Types of Massachusetts and Their Uses," Agr. Exp. Sta., Amherst, Mass., Bul. 385, May 1941, A. B. Beaumont.

"Soil Survey of Pangasinan Province, Philippines," Dept. of Agr. and Comm., Manila, P. I., Soil Rpt. 7, M. M. Alicante, D. Z. Rosell, R. T. Marfori, and S. Hernandez.

"Questions and Answers Regarding Wyoming State Soil Conservation Districts Law," Agr. Ext. Serv., Laramie, Wyo., Cir. 78, June 1941, Donald A. Ritter.

"Publications and Visual Information on Soil Conservation," U. S. D. A., Washington, D. C., Misc. Pub. 446, May 1941.

Crops

¶ Many agriculturists are of the opinion that corn yields on many farms of the South are much lower than they should be or even need be. Practices to be followed for increasing yields are given by H. A. Woodle in Clemson Agricultural College Extension Circular 194, "Corn Production in South Carolina." Since part of the problem in increasing corn yields involves an improvement in the general program of the farm, improved rotations including cover crops and legumes are first suggested. Planting of the crop on reasonably fertile soil, combined with the use of adapted varieties, including hybrids, and proper fertilization, soil preparation, cultivation, and harvesting methods are also necessary if good yields are to be obtained.

The fertilization of the crop will vary with the fertilizer practices of the entire rotation. Phosphate and potash will usually be required on all soils except where heavily fertilized cotton or tobacco has preceded corn, in which case a nitrogen top-dressing may be sufficient. Where good supplies of high-quality manure are available, phosphate alone may suffice. Where a legume precedes corn in a grain and hay rotation, 0-12-12 or 0-16-8 at 200 to 400 pounds per acre is recommended. In a similar rotation where a legume crop does not precede corn, 5-10-5 or 4-12-4 at 200 to 400 pounds per acre with nitrogen as a side-dressing is recommended.

Where potash deficiency shows up on corn it is advisable to use more potash. It is stated, "When definite potash deficiency has been observed, 50 pounds or more of muriate of potash or its equivalent should be applied per acre." Best results will usually be obtained if the soil is only moderately acid, which means that lime should be applied on the very acid soils. Magnesium and manganese deficiencies are likely to show on the very acid and very alkaline soils, respectively, and where these deficiencies have been observed, appropriate sources of magnesium or manganese should be applied.

¶ Taro is an important starchy crop in Hawaii and is subject to numerous diseases, particularly if growing conditions are unfavorable. These diseases and methods of combating them are discussed by G. K. Parris in Hawaii Agricultural Experiment Station Circular 18, "Diseases of Taro in Hawaii and Their Control." Owing to the great influence of growing conditions on sus-

ceptibility to disease, considerable attention is given to proper fertilization. It would appear that much is yet to be learned concerning the fertilizer needs of this crop, but evidence at hand indicates that fertilizers in 1:1:1 or 1:2:2 ratios are well suited for the crops growing under wet land conditions. In experiments conducted on upland Taro potash appeared to be particularly important. In the limited evidence available there appears to be little direct correlation between fertilizer treatment and control of any specific disease, although the desirability of proper fertilization to build up the vigor of the plant is emphasized.

¶ The production of another tropical fruit, papaya, is very completely covered in Hawaii Agricultural Experiment Station Bulletin 87, "Papaya Production in Hawaiian Islands," by W. W. Jones, W. B. Storey, G. K. Parris, and F. G. Holdaway. The botany, culture, diseases, insect pests, harvesting, marketing, and uses of the fruit are considered. While complete fertilizers usually are needed, information on requirements of this plant is only in process of being obtained. Pending further results of investigations under way, fertilizers such as 6-12-6 or 8-12-6 are recommended.

¶ There probably is nothing that will more easily or more permanently beautify home grounds, whether in the country or the city, than well-cared-for trees. While nature has provided trees with a remarkable ability to adapt themselves to their environment, a certain knowledge of suitable types of trees, their care, pruning, and fertilization is necessary if best results are to be obtained. Information of this type is given in Purdue University Extension Bulletin 252 entitled "Trees, Their Planting and Care" by R. B. Hull. By means of well-chosen illustrations and diagrams, suggestions are made as to location of trees, methods of planting, pruning, fertilization, and general care. A full list of recommended trees for the Corn Belt area is also included.

¶ A lawn is a natural complement to trees around the home, and Purdue Extension Service Bulletin 254, "The Lawn," is a good companion publication to the one on trees mentioned above. Information on the establishment, maintenance, and renovation of lawns is given. Grading, fertilization, liming, seeding, weed control, and pest control are covered briefly and in a non-technical manner. In the fertilization of a lawn complete fertilizers usually are recommended except on dark, fertile soils, in which case the nitrogen may be omitted. Analyses such as 4-10-6, 3-12-12, 2-12-6, 0-14-6, and 0-20-10 are recommended for application when starting new lawns, while 10-6-4 and 4-10-6 along with straight nitrogen top-dressers are recommended for fertilization of established lawns.

¶ Investigators and others having need to look up literature on corn will do well to consult "Maize Bibliography for the Years 1917 to 1936, Inclusive" compiled by J. C. Cunningham and issued as the March 1941 number of Contributions from Iowa Corn Research Institute of the Iowa Agricultural Experiment Station. This comprehensive bibliography contains more than 1,100 citations grouped by subject and by author.

¶ Another subject now being given great emphasis is vegetable growing, particularly in small gardens for home use, and numerous publications on this are being issued. North Carolina Extension Circular 122, "The Farm and Home Garden Manual," by H. R. Niswonger, gives practical points on planting a home garden; how to fertilize it; what vegetables to grow; time, method, and rate of planting; varieties; pest control; and other related information. In connection with fertilization of the crop, it is suggested that good barnyard manure makes an excellent material for fertilization but usually this has to be supplemented with commercial fertilizer, and if large amounts of manure

are not available, much more fertilizer is needed. Well-balanced complete fertilizers should be used with the rate of application up to one ton per acre of fertilizer broadcast.

A much more condensed publication on the same general subject entitled, "The Home Garden and the 1941 Agricultural Conservation Program," North Carolina Extension Folder 45, by H. R. Niswonger and M. E. Thomas, states that a 5-7-5 fertilizer is typical of the type used in gardens. Information similar to that contained in the above publications, but in somewhat greater detail, is given in Georgia Experiment Station Bulletin 215, "The Home Vegetable Garden," by H. L. Cochran. Heavy fertilization is recommended, such as about 1,500 pounds per acre of 8-8-6, 8-8-8, or 8-8-10 with extra nitrogen top-dressing sometimes being needed. If large amounts of manure are available, the amount of fertilizer used can be reduced.

Hawaii Agricultural Extension Circular 118 entitled, "The Home Garden," gives information adapted to Hawaiian conditions. A 4-12-8 fertilizer is recommended with additional nitrogen top-dressings sometimes being needed. "The 4-H Way to Profitable Potato Production", Indiana Extension Bulletin 253, by W. B. Ward and W. R. Amick, gives much practical information on the growing of potatoes on a small scale in a garden. It is suggested that 500 to 1,000 pounds per acre of 3-12-12 fertilizer be used except on muck soils, where 0-8-24 should be applied. Proper cultural, harvesting, and marketing practices are given.

Two other bulletins were prepared more for commercial vegetable growers, but in addition to being useful to them they will be of interest to the small gardener. One of these, "Starting Vegetable Plants," by G. J. Raleigh, Cornell Extension Bulletin 448, gives detailed information on starting plants in coldframes, hotbeds, and glass houses. Soil preparation and fertilization, seeding, transplanting, watering, hardening the plants, and setting them in the field are considered. In "Growing and Marketing Georgia Sweet Potatoes," Georgia Extension Bulletin 482, E. Ragsdale and L. E. Farmer give rather complete and very practical information on the growing of this important staple crop which may be considered either as a vegetable or as a field crop. In connection with fertilization, it is suggested that 600 to 800 pounds per acre of a fertilizer analyzing around 4% nitrogen, 8 to 9% phosphoric acid, and 10 to 12% potash be used.

¶ Anyone considering the growing of mushrooms on either a large or small scale could well consult U. S. Department of Agriculture Farmer's Bulletin 1875, "Mushroom Growing in the United States." The author, E. B. Lambert, has assembled very complete and practical information on the various factors to be considered in growing mushrooms and gives rather detailed information on how to grow this highly specialized crop.

"Peach Varieties in Arkansas," Agr. Exp. Sta., Fayetteville, Ark., Bul. 414, June 1941, J. E. Vaile.

"Thirty-fifth Annual Report of the Department of Agriculture for the Year 1940," B. C. Dept. of Agr., Victoria, B. C., Can.

"Sixty-sixth Annual Report of the Ontario Agricultural College and Experimental Farm, 1940," Ont. Dept. of Agr., Guelph, Ont., Can.

"Annual Report for the Year Ending October 31, 1940," Agr. Exp. Sta., New Haven, Conn., Bul. 446, July 1941.

"Diseases of Taro in Hawaii and Their Control," Agr. Exp. Sta., Honolulu, T. H., Cir. 18, May 1941, G. K. Parris.

"Papaya Production in the Hawaiian Islands," Agr. Exp. Sta., Honolulu, T. H., Bul. 87, June 1941, W. B. Storey.

"The Potato—Its Nutritive Values," St. Dept. of Agr., Boise, Idaho.

"Indiana's Progress in a Changing Agriculture," Agr. Ext. Serv., Lafayette, Ind., 29th An. Rpt. of Dir., July 1, 1939 to July 1, 1940.

"Trees, Their Planting and Care," Agr. Ext. Serv., Lafayette, Ind., Ext. Bul. 252, Jan. 1941, R. B. Hull.

"The Lawn, Its Making and Maintenance," Agr. Ext. Serv., Lafayette, Ind., Ext. Bul. 254, Jan. 1941.

"Better Grapes from Indiana Gardens and Vineyards," Agr. Ext. Serv., Lafayette, Ind., Ext. Bul. 267, June 1941, Clarence E. Baker and Monroe McCown.

"Growing Bush Fruits in Kansas," Agr. Exp.

Sta., Manhattan, Kans., Cir. 204, Mar. 1941, G. A. Filinger.

"Fifty-third Annual Report, for the Year 1940," Agr. Exp. Sta., Lexington, Ky.

"Annual Report of the Director of Agricultural Extension for the Year Ended December 31, 1940," Agr. Ext. Serv., Lexington, Ky., Cir. 363.

"Garlic as a Truck Crop," Agr. Ext. Serv., University, La., Ext. Cir. 210, Apr. 1941, G. L. Tiebout.

"The Vegetable Pear," Agr. Ext. Serv., University, La., Ext. Cir. 211, May 1941, G. L. Tiebout.

"Globe (Bur) Artichokes for the Home Garden," Agr. Ext. Serv., University, La., Ext. Cir. 212, May 1941, G. L. Tiebout.

"Brussels Sprouts for the Home Garden," Agr. Ext. Serv., University, La., Ext. Cir. 213, May 1941, G. L. Tiebout.

"Rhubarb Culture for Louisiana," Agr. Ext. Serv., University, La., Ext. Cir. 214, May 1941, G. L. Tiebout.

"Raspberry Growing in Michigan," Agr. Exp. Sta., East Lansing, Mich., Cir. Bul. 152, Rev. Oct. 1941, R. E. Loree.

"Minhybrid Corn Varieties for Minnesota," Agr. Exp. Sta., University Farm, St. Paul, Minn., Bul. 354, June 1941, H. K. Hayes, R. P. Murphy, E. H. Rinke, and Carl Borgeson.

"Date and Rate of Lawn Seeding," Agr. Exp. Sta., University Farm, St. Paul, Minn., Bul. 355, June 1941, L. E. Longley.

"The Effect of Genetical Factors, Seasonal Differences and Soil Variations Upon Certain Characteristics of Upland Cotton in the Yazoo-Mississippi Delta," Agr. Exp. Sta., State College, Miss., Tech. Bul. 28, Dec. 1940, J. Winston Neely.

"Fifty-fourth Annual Report," Agr. Exp. Sta., Lincoln, Nebr.

"Studies on Bitter Pit of the Apple," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Memoir 234, Apr. 1941, R. M. Smock.

"Report of The North Carolina Department of Agriculture from July 1, 1938 to June 30, 1940," St. Dept. of Agr., Raleigh, N. C.

"Annual Report for 1940," Agr. Ext. Serv., Kingston, R. I., Bul. 80, Mar. 1941.

"Fifty-third Annual Report," Agr. Exp. Sta., Kingston, R. I., Contb. 586, June 1941.

"Extension Work in South Carolina, 1940," Agr. Ext. Serv., Clemson, S. C., An. Rpt. of Dir.

"Corn Production in South Carolina," Agr. Ext. Serv., Clemson, S. C., Cir. 194, May 1941, H. A. Woodle.

"Questions and Answers on Fruit Culture," Agr. Exp. Sta., Brookings, S. Dak., Cir. 35, June 1941, Niels E. Hansen.

"Questions and Answers Concerning the Use of Kudzu in Tennessee Under the 1941 AAA Program," Agr. Ext. Serv., Knoxville, Tenn., Sp. Cir. 140, Feb. 1941, H. E. Hendricks.

"Questions and Answers Concerning the Use of Bermuda Grass in Tennessee Under the 1941 AAA Program," Agr. Ext. Serv., Knoxville, Tenn., Sp. Cir. 141, H. E. Hendricks.

"Fifty-third Annual Report, 1940," Agr. Exp. Sta., College Station, Tex.

"Nursery Practice for Trees and Shrubs Suitable for Planting on the Prairie—Plains," U. S. D. A., Washington, D. C., Misc. Pub. 434, Aug. 1941, H. E. Engstrom and J. H. Stoeckeler.

"Mushroom Growing in the United States," U. S. D. A., Washington, D. C., Farmers' Bul. 1875, June 1941, Edmund B. Lambert.

"Crested Wheatgrass," U. S. D. A., Washington, D. C., Leaflet 104, Rev. Jan. 1941, H. L. Westover and George A. Rogler.

"Report on the Agricultural Experiment Stations, 1940," U. S. D. A., Washington, D. C., July 1941, J. T. Jardine, F. D. Fromme, and H. L. Knight.

Economics

¶ "Price Flexibility and Price Movements in the United States and Other Countries" is the title of Cornell University Memoir 239 by Mark T. Buchanan. In recent years much has been said about price flexibility and inflexibility, sometimes referred to as "variations in price flexibility" by the price statisticians. Much of our economic distress in the past has been attributed to the fact that some prices change more rapidly and in greater amounts than do others. The author states that it was his purpose in making the study to examine variations in the price flexibility of internationally important products, and to determine their relation to international price movements and price alignment between countries. The study was based on an analysis of price movements of 56 to 64 internationally important products for four countries—the United States, Canada, the United Kingdom, and France.

The author's definition of "flexible" is in general about the same as that applied by most price analysts, which is, that "flexible" is applied to those products whose prices changed more frequently and/or more in amount than did prices of other products. Conversely, the term "inflexible" is applied to those products whose prices changed less frequently and/or less in amount than did prices of other products.

As a means of measuring price flexibility, an index of frequency of price change was calculated, and in order to

measure the amplitude of change an index of amplitude of price change was computed by the author. Comparisons of the relative flexibility of prices in each country were made for the 8-year period, 1922-1929, for the 9-year period, 1930-38, and for the 17-year period, 1922-1938. Comparisons of flexibility between countries were also made.

Generally speaking, it was observed that processed materials had lower price flexibility than basic commodities. The prices of food and raw textiles were more flexible than were the prices of other products. Generally speaking, agricultural prices were more flexible than were the prices of products of other industries. It was also observed that products in higher stages of fabrication and durable goods were less flexible than prices of non-durable and semi-durable goods. The prices of consumers' goods remained more stable than prices of producers' goods.

It was observed by the author that products representing a considerable addition of labor, transportation, and other inflexible charges were less flexible in price than were the products representing smaller amounts of labor and other fixed charges. This suggested that probably a large part of the difference in price flexibility between commodities was primarily based upon the amount of labor, transportation, etc., entering into the price. In general, it was observed that similar products in different countries had about the same price flexibility.

The author does not attempt to prove the relative merits of a flexible or inflexible price system, but the study did indicate clearly that the differences in the degree of price flexibility between different industries and different commodities caused economic disturbances to be more severe during periods of falling prices. It was this factor, of course, that led to the widespread agricultural chaos during the period of falling prices just after the first World War. During periods of rising prices or periods of stability, differences in price flexibility are not nearly so important from the economic standpoint, but when prices decline rapidly, prices of raw materials and other flexibly priced products decline much faster than do prices of the finished goods. In general this disparity between the prices of these two groups of commodities continues until the general price levels turn upward. With a rise in prices the disparity is largely corrected as a result of the same situation which caused it originally—flexible prices moving faster than inflexible prices.

It is the author's opinion that if the prices of all products moved more closely together, business activity would not be so severely retarded during periods of price decline. This is due to the fact that prices of raw materials which decline much faster than finished goods result in a rapidly declining purchasing power of producers of raw materials. This results in a reduction in industrial production because the producers of finished goods produce only about what they are able to sell at a stated price which of necessity is usually high enough to cover at least operating costs. But even though wage rates may remain high, the actual purchasing power of labor declines because with the reduction in business activity less hours of labor are needed and labor's total income declines rapidly, resulting in a vicious cycle.

From the international viewpoint it was observed that prior to the depreciations in the thirties, little or no disparity existed between prices of a given flexibility in one country and prices of similar flexibility in another. The wide disparities appeared with the decline in commodity prices during the great depression in the thirties. The result was that the currencies in each country studied became relatively overvalued in terms of raw products and relatively undervalued in terms of finished goods. The author concluded that the internal overvaluations and undervaluations were probably more important in causing depreciation than the very slight external overvaluations and undervaluations. After the depression large dif-

ferences in prices between countries appeared because prices in the different countries did not react in proportion to the changes in exchange rates. A part of the discrepancy between different countries may have been due to lagging price adjustment and a part to tariffs, quotas, export bounties, and other trade restrictions which were inaugurated in varying degrees in all countries during the thirties.

"Delaware Farm Production and Prices," Agr. Exp. Sta., Newark, Del., Bul. 230, May 1941, C. E. Burkhead and R. O. Bausman.

"A Study of Celery Farming on the Everglades Organic Soils, Palm Beach County, Florida, Seasons 1937-38 to 1939-40," Agr. Ext. Serv., Gainesville, Fla., Celery AE3, May 1941, R. H. Howard and M. U. Mounts.

"The Community Situation As It Affects Agricultural Extension Work," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 312, Oct. 1941, C. R. Hoffer and D. L. Gibson.

"Marketing Sweet Potatoes in New Jersey and Competing States," St. Dept. of Agr., Trenton, N. J., Cir. 328, June 1941, John M. Fenton.

"Apple Trees in Burlington and Gloucester Counties, New Jersey," St. Dept. of Agr., Trenton, N. J., Cir. 330, July 1941, D. T. Pitt.

"Price Flexibility and Price Movements in the United States and Other Countries," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Memoir 239, June 1941, Mark T. Buchanan.

"Level of Living, Social Participation, and Adjustment of Ohio Farm People," Agr. Exp. Sta., Wooster, Ohio, Bul. 624, Sept. 1941, A. R. Mangus and Howard R. Cottam.

"An Economic Study of Land Classes, Blair County, Pennsylvania," Agr. Exp. Sta., State College, Pa., Bul. 413, Apr. 1941, W. E. Keeper.

"Cotton Marketing in South Carolina," Agr. Exp. Sta., Clemson, S. C., Bul. 335, Oct. 1941, W. T. Ferrier and H. A. White.

"Should Farmers Emphasize Wheat or Livestock in North Central South Dakota?," Agr. Exp. Sta., Brookings, S. Dak., Cir. 33, June 1941, Aaron G. Nelson and Gerald E. Korzan.

"Food for Defense Goals," Agr. Ext. Serv., Knoxville, Tenn., Pub. 255, Oct. 1941.

"1942 AAA Farm Programs," U. S. D. A., Washington, D. C., ECR-601: Kentucky, Aug. 26, 1941; Maryland and Delaware, Sept. 16, 1941; North Carolina, Sept. 3, 1941; Tennessee, Sept. 3, 1941; Virginia, Oct. 10, 1941; West Virginia, Aug. 26, 1941.

"1942 AAA Handbooks," U. S. D. A., Washington, D. C., SRB 601, Oct. 1941: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Oklahoma, South Carolina, Texas.

"1942 Agricultural Conservation Programs," U. S. D. A., Washington, D. C., NER 610: Connecticut, Sept. 25, 1941; Maine, Sept. 25, 1941; Massachusetts, Sept. 25, 1941; New Hampshire, Sept. 20, 1941; New Jersey, Sept. 27, 1941; New York, Sept. 26, 1941; Pennsylvania, Oct. 3, 1941; Rhode Island, Sept. 25, 1941.

Plant Symptoms Show Need for Potash

(*From page* 20)

sue. In all cases the "very yellow" leaves were low in potassium while the "green" leaves ranged in potassium content from medium to very high. Of particular interest were the samples from the same field, one from a "yellow spot" and the other from normal plants. In every instance where this comparison was possible, the yellow leaves contained much less potassium than the normal leaves.

The phosphorus contents of the samples varied widely. There seemed to be a tendency for the yellow samples, low in potassium, to be high in phosphorus, but there were so many exceptions to this condition that no conclusions could be drawn.

During this survey a type of yellowing somewhat different from that observed on the Ovid experimental field was encountered. Instead of the yellowing being more intense around the leaf edges it was uniform over the entire leaf, as shown in Fig. 6. The leaf-tissue tests showed these plants to be high in potassium, so the yellowing must have been due to some deficiency

other than potash. Results of some work performed in this department by G. D. Sherman indicated that it might have been the result of manganese starvation.

This is a good illustration of the need for careful study in dealing with deficiency symptoms. It is not sufficient to say that yellowing of beans is indicative of potash starvation, but it is essential that the nature of the yellowing be carefully described. Similar instances have been noted with regard to deficiency symptoms on other plants.

As already mentioned, the field experiments on the Ovid farm showed that soybeans starved for potash developed symptoms similar to those on white beans. Accordingly, leaf samples were gathered from five different fields where the leaves on a part of each field resembled the leaf shown in Fig. 7.

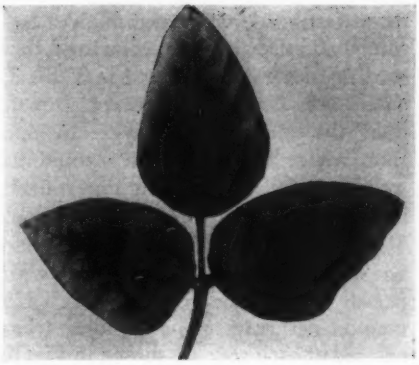


Fig. 7. A soybean leaf showing the characteristic yellowing caused by potash starvation.

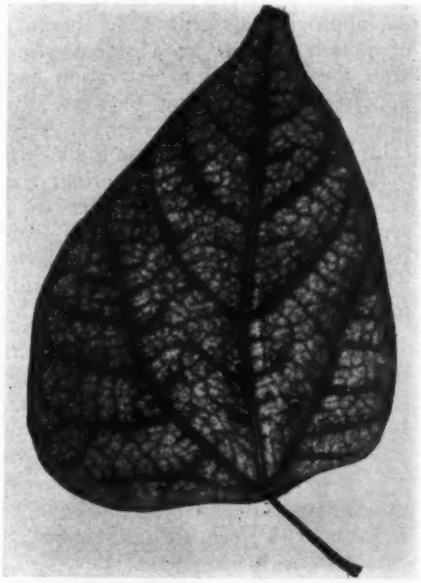


Fig. 6. A bean leaflet yellowed as a result of some deficiency other than potash.

Samples of the yellow-edged leaves from each field were analyzed for potash and phosphorus, and the results were compared with those obtained from the analyses of normal plant leaves taken from different parts of the respective fields. The data obtained showed that in all fields the yellow-edged leaves were much lower in potash than the leaves from normal plants. As in the case of white beans, there was no correlation between the leaf color and the phosphorus content of the fresh leaf tissue.

As a further test of the reliability of the symptoms, several rows of the soybeans on one of the Hillsdale sandy loam farms were side-dressed on August 2 with muriate of potash at the rate of 100 pounds per acre. The potash was applied in a band close to the row with a hand fertilizer distributor. By September 6, the day of harvest, the

TABLE 3.—THE EFFECT OF POTASH, APPLIED AS A SIDE-DRESSING ON AUGUST 2, ON THE YIELD OF SOYBEAN HAY HARVESTED SEPTEMBER 6. HILLSDALE SANDY LOAM.

Treatment	Yield— Lb. dry hay per acre	
	Field 1*	Field 2**
None	3781	2523
Muriate of potash 100 lb. per acre	4787	3133

* Average of 3 replicates.
** Average of 2 replicates.

rows fertilized with potash had assumed a normal green color and, according to the data reported in Table 3, had made considerably more growth than the unfertilized rows. In one spot where the starvation symptoms were especially severe, an unfertilized row was found to yield at the rate of 3,267 pounds of dry hay per acre, while an adjoining row side-dressed with potash yielded at the rate of 5,228 pounds per acre. The bundles from one rod of each row are shown in Fig. 8.

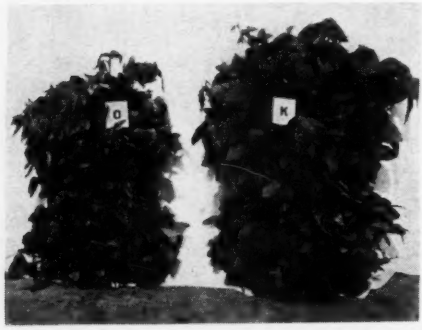


Fig. 8. Soybeans need potash. The left bundle was harvested from one rod of row which bore symptoms of potash starvation. The right bundle came from one rod of an adjoining row side-dressed with muriate of potash after starvation symptoms had appeared.

While no data on the subject are available, it was noticed at the time of making the side-dressing on August 2 that the roots of normal green plants were more plentifully supplied with nodules than the yellow-leafed plants. Also, the nodules were larger on the healthy plants.

Cowpeas are rather widely grown in St. Joseph County, Michigan, and several fields were found where the leaves of the plants in parts of the fields were yellowed on the edges as shown in Fig. 9. The resemblance to the potash-starved leaves of white beans and soybeans was so striking that samples of the fresh tissue were analyzed. The relationship between the leaf color and the potassium and phosphorus content of the fresh leaf tissue was the same as has been reported for the other two crops.

Summary and Conclusions

As a result of a field plat experiment with white beans, it was decided that a certain characteristic yellowing of the leaves was due to a deficiency of soil potash. On the plats which did not receive potash, the yellowing started at the ends and edges of the leaflets and gradually worked toward the center and base until the entire leaflet was yellow. Three hundred pounds of a fertilizer containing eight per cent potash were sufficient to prevent this abnormal condition and to greatly increase the yields. An approximately equivalent quantity of potash applied as a side-dressing after the symptoms of starvation had appeared was sufficient to cause the beans to regain their normal green color and to greatly increase the yields.

As a means of testing further the reliability of the yellow leaves as a symptom of potash starvation, leaf-tissue tests were made on "yellow-edged" and normal leaves from 40 different fields. Without exception the

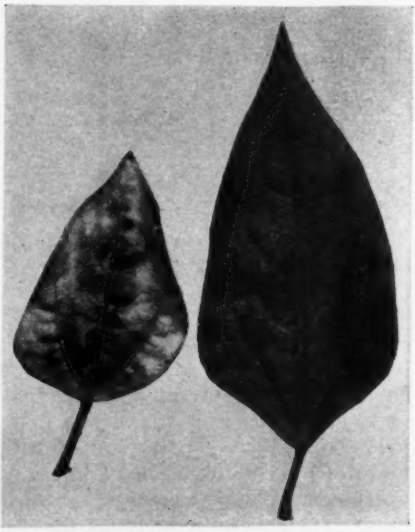


Fig. 9. Cowpeas also need potash. The left leaflet shows the yellowing characteristic of potash starvation. The right leaflet is from a normal plant.

normal green leaves contained much more potash than the "yellow-edged" leaves. There were no consistent variations in phosphorus content. It was concluded, therefore, that the characteristic yellowing was actually a symptom of potash starvation and that the symptoms were rather general through the bean-growing area of Michigan.

Based on plant-tissue tests, the same symptoms were found to hold for soybeans and cowpeas. The reliability of the symptoms in the case of soybeans was further proved by field plat tests. Plants grown on plats which did not receive potash at planting time produced characteristically yellow leaves, while potash-treated plants produced normal green leaves. As in the case of white beans, a side-dressing of muriate of potash, made after the symptoms appeared, caused the plants to regain their normal appearance and resulted in markedly increased yields.

Potash Demonstrations on State-wide Basis

(*From page* 22)

There was an average of 3 work stock, less than 2 beef cattle, and 5 dairy cows per farm. There was an average of 13 hogs per farm, most of these being in the eastern section. Poultry averaged 94 birds for all the farms.

In the estimated budget of receipts on these farms, it is revealed that crop receipts in the eastern were much higher than in the Piedmont or mountain sections, while livestock receipts were somewhat high in the Piedmont and mountain. Receipts for dairy products were very low in the eastern, higher in the Piedmont and mountain areas. The estimated total receipts average $2,345 for all 94 farms. The eastern cash receipts averaged $2,644; the Piedmont $2,099; while the figure was only $1,629 for the mountain group. However, estimated farm expenses were considerably higher in the eastern than in the Piedmont or mountain sections. Expenses averaged $1,086 for all 94 farms; $1,256 for the eastern, $945 for the Piedmont, and $683 for the mountain farms.

The average estimated expense for fertilizer for all the farms was $228 per farm. The eastern averaged $295, the Piedmont $173, and the mountain $67 per farm.

The estimated total family living expense averaged $372 for all farms; $420 for the eastern, $344 for the Piedmont, and only $224 for the mountain. The family living expenses included food, clothing, fuel, household needs, and automobile expense. These added to farm expenses made an average of $1,458 for all farms; $1,676 for the eastern, $1,289 for the Piedmont, and $907 for the mountain farms.

The application of potash for demonstration purposes on these 94 farms was divided on the following crops: 8% on small grain alone which amounted to 228 acres; 13% on soybeans which amounted to 345 acres; 27% on small grain and lespedeza, 529 acres; 10% on lespedeza alone, 262 acres; 4% on crimson clover, Austrian winter peas, and vetch, 120 acres; 17% on meadow and miscellaneous crops, 350 acres; 19% on permanent pasture which amounted to 424 acres. There was also a small amount of acres in other crops. The rate of application varied considerably according to the soil type and section of the State. These recommendations were based upon the Experiment Station's findings in the particular areas. The rate of application in the eastern part of the State was much higher than in the other sections.

All of these demonstration farmers are keeping a complete record of farm operations during the year and this program will be conducted according to the plans originally set up.

A Five-year Program for Corn-Livestock

(*From page 9*)

By adding a reasonable amount of good complete fertilizer to the corn crop and keeping the humus in the soil, many farmers are able to plant the land continuously in this crop and receive better yields year after year.

In 1939 W. O. May of the Reedy Creek community planted his corn in 6-foot rows interplanted with velvet beans and peanuts. He used 200 pounds of 2-10-4 fertilizer under the corn then top-dressed with 100 pounds nitrate of soda. His yield was 48 bushels to the acre plus sufficient peanuts and velvet beans to give 300 to 400 pounds livestock gain per acre. Using the same methods and same fertilizer in 1940 he was again tops in his district on interplanted corn with 52 bushels to the acre plus an unusually fine yield of feed.

Part of the field was used for his tobacco and cotton allotments in 1941 and only about 4 acres were left for corn. His 10-acre contest corn was transferred to another field, but on the 4 acres he received better than 60 bushels per acre. Continuous satisfactory corn yields are possible where proper care is given to fertilizing and humus is added to the soil. This of course would not be practical with solid corn without continuous planting of winter legumes.

Wm. G. Newton and son David last year planted 90 acres of corn, all fertilized and mostly interplanted. They exchanged their cottonseed for cottonseed meal, harvested 30 acres of good oats followed with lespedeza that yielded 34 tons. They ground their own corn and hay and fed out 57 head of cattle that were raised on the place. They sold more than $3,000 worth of cattle, added several good heifers to their herd, fed their work stock, and finished several hundred dollars worth of pork for the market.

In 1941 they produced 509 bushels of corn on 10 acres plus a good crop of soybeans and velvet beans that added another 150 bushels feed value. For the Newtons this won a purebred bull calf worth $150. This bull added to an already good herd of grade cattle, and backed by a general farm program that assures the herd plenty of good feed at a low cost, is putting the Newton family in the livestock business in a big way. Mr. Newton told the writer that 7 years ago it was difficult to obtain a yield of 10 bushels of corn per acre from the land that this year produced in terms of feed an equal of 65 bushels of corn per acre. This increased yield was obtained by a program of interplanted feed crops with corn, harvested mostly by cattle and hogs, and all the litter turned under with an occasional winter legume crop and a reasonable amount of fertilizer. This year they followed a good cover crop of Austrian winter peas with corn fertilized with 175 pounds of 2-10-4 per acre. The actual fertilizer cost was $1.97 per acre. Mr. Newton is Chairman of the County Board of Education and is well past his 70th birthday. He is still an active farmer and a leader in his community.

Below are some of the actual fertilizer practices and yields secured in the 1941 contest:

John W. Good:
400 lbs. 4-8-6 under the corn.
100 " nitrate of soda top-dressing.
Yield, 55.2 bu. per acre.

Mrs. Ella Norman:
275 lbs. 3-8-6 under the corn.
200 " 10-0-10 top-dressing.
Yield, 66.5 bu. per acre.

W. F. Westbrook:
300 lbs. 2-10-4 under the corn.
100 " soda top-dressing.
Yield, 58.4 bu. per acre.

W. F. Brogdon:
Austrian winter peas turned under.
250 lbs. 0-12-4 under the corn.
No top-dressing.
Yield, 57.4 bu. per acre.

Ben Galloway
and
Cooper Brothers:
Austrian winter peas turned under.
400 lbs. 4-8-6 under the corn.
200 " nitrate soda top-dressing.
Yield, 75.7 bu. per acre.

Mallie Norman:
400 lbs. 4-8-6 under the corn.
100 " nitrate soda top-dressing.
Yield, 63.2 bu. per acre.

Davis Jenkins:
75 lbs. 2-10-4 under the corn.
200 " nitrate soda top-dressing.
Yield, 79.7 bu. per acre.

In very few instances where a good crop of Austrian winter peas was turned under before planting corn was there any nitrate of soda used for top-dressing. But a careful study of all the fertilizer practices used by the farmers participating in the contest clearly shows that corn does need a complete fertilizer on Colquitt County soils, and it pays to use up to 400 pounds mixed goods plus either soda or up to 200 pounds per acre of 10-0-10 as a top-dressing. The excessive use of fertilizer has been discouraged by the agricultural workers in the county and the value of complete plant food plus plenty of humus in the soil stressed.

Corn is Food for Defense

In our present National Emergency we are in need of increased food production. The Secretary of Agriculture is calling on the farmers to produce more pork, beef, chickens and eggs, and certain other products. It is estimated that because of the contest 650,000 bushels of corn were added to Colquitt County's 1941 corn crop and that were the entire increase fed to hogs with a return of 100 pounds gain for each 10 bushels of corn fed, we would have an increase of 6,500,000 pounds of pork. This restated in terms of dressed pork, edible cuts that might be served on the table, would make one liberal serving for more than 9,000,000 persons. Thus are Colquitt County farmers responding to the call for food for defense.

Many neighboring counties in Georgia have taken up the 10-acre corn contest idea. Both Thomas and Brooks Counties have put on contests this year that created widespread interest among their farmers and will in all probability rival in yields the Colquitt County results. Many other counties have become interested and are conducting some kind of corn-livestock program modeled after the Colquitt contest.

We believe the practices to be sound. We are encouraging better cultural methods, better crop rotations, along with better livestock. There are several farms with excellent first cross white-faced calves this year, offspring of the first eight purebred bulls given as prizes, that would not have had them otherwise. There is a county-wide interest in livestock. There are many more good purebred bulls, boars, and breeding animals in the county now than there were three years ago. The farmers have learned that they can breed, raise, feed, and sell good hogs and cattle with feed raised at home, cheap feed in abundance, and that they need buy only small amounts of protein supplements, salt, and mineral matter for their livestock.

Results Encouraging

After carefully surveying the results of this new trend and then interpreting them in terms of future results it is hard to be anything but enthusiastic about the program. There is every reason to believe that it will spread to include all the great Coastal Plains belt of the Southeast. It has demonstrated fully that corn can be produced in sufficient yields and at low enough cost to make it a practical and economical source for feed on which to finish our hogs and cattle for the market. Corn can be stored and used when needed. For a long time we have been talking about our livestock program in the South. We have made great progress during the past few years, but we have been handicapped by low yields of basic feeds. It has now been proven that a satisfactory feed can be produced cheaply and in abundance.

The Colquitt County program calls

for one additional thing that, if and when accomplished, should complete this picture. We plan to reduce our corn acreage from 75,000 to 50,000 acres and on the 50,000 acres produce a crop of 2,000,000 bushels of corn annually. The 25,000 acres taken from corn we hope to turn to oats, lespedeza, and permanent pasture. This will, when added to the present pasture lands, supply sufficient improved pasturage for our livestock, and we will be able to market an annual livestock crop worth more than $2,000,000. This crop when marketed will be adding to the fertility of our soils each year instead of depleting it, and fits in well with a general diversified farm program.

Borax Helps Prevent Alfalfa Yellows

(*From page* 12)

relatively small, alfalfa growers in Tennessee who experience trouble with alfalfa "yellows" are advised to use within the range of the application, 20 pounds per acre, with which we have had experience, until further knowledge has been obtained.

Additional test demonstrations are planned to afford a more thorough coverage of soil conditions in Tennessee and when these are integrated with the experimental work of the Tennessee Experiment Station, there should be, in a few years, a more definite answer to the many questions that can be raised now with respect to the value of borax in alfalfa production in Tennessee.

Some Newer Ideas on Orchard Fertility

(*From page* 16)

fertilizer material, rather than a soil corrective."

In Better Crops With Plant Food, May 1937, F. W. HofMann of the Virginia Agricultural Experiment Station states, "If the orchard soil is not strong enough to maintain a good crop of grass or sod, it should receive 600 to 800 pounds of an 8-6-6, 6-8-6, or 10-6-4 fertilizer. If the soil is capable of producing a lush growth of grass or sod, the fertilizer application may be more confined nearer the area under the spread of the tree and to fertilizers with the higher nitrogen content."

In Better Crops With Plant Food, August-September, 1936, E. H. Rawl of Clemson College, South Carolina, recommends the use of a complete NPK fertilizer in the peach orchard plus the use of dolomitic limestone. In the South Carolina peach tests not only foliage and tree growth but size of fruit was greatly improved by the use of complete fertilizer plus the limestone. It is interesting to note that where such fertilization was given good stands of cowpea cover resulted under the spread of peach tree branches.

From Pennsylvania State College Agricultural Experiment Station Bulletin 294: "The fertility of an orchard soil is more than its plant-food content. It involves the nature of the soil, its depth and topography, its previous treatment, the use of fertilizers and manures, the amount and nature of the cultivation, and the cover or sods grown. Fertilizers are only part of the problem of soil fertility.

"In this orchard any treatment that has influenced the trees at all has done

so in the following order: first, the cover crops; perhaps several years later, leaf color; shortly after, branch growth and circumference increase; and last of all yield.

"The reason for this sequence of results is that the treatments—whether chemical fertilizers, manure, or cover crops—have influenced yields chiefly by changing the organic matter content of the soil; that is, those treatments which have resulted in the production of larger cover crops have ultimately resulted in the production of more fruit.

"A short, non-legume sod rotation is an efficient means of building up a depleted orchard soil. After a sod of any kind becomes thick, tree growth is checked and yields decline. Orchard sods should be turned under, or partially broken, frequently.

"Trees receiving annual tillage with July seeding of cover crops have not done so well as those under sod rotations. If the cover crops are seeded in early June, as has been practiced since 1929, the difference may not be marked."

Most orchard owners are interested to learn that it took 16 years of clean cultivation and late summer seeding of non-legume covers to so deplete this Hagerstown clay-loam soil of organic material and exhaust the nutrients to points low enough to even show in tree growth and yield. Cover growth began to show the need of food in the fifth to seventh year.

In the case of the legume covers, nitrogen was being returned to the soil by the legume plants. This resulted in better covers each year. The trees with legume covers showed no need of food after 22 years of growth. As orchards grow older, the need of complete fertilizers for both the trees and cover crops will become more marked.

Referring to your Professor Hoffmann's report on fertilizers for orchard soil fibre in the Virginia State Horticultural Society report for 1939, we find that his studies show much more growth of cover material resulting from the use of phosphate and potash when used along with nitrogen, than when nitrogen was used alone.

Let me here and now make a plea for the use of complete food for our orchards, for the use of phosphate, the use of potash, the use of calcium (lime); for the right use of cover crops, yes, for the use of legume cover crops. If an orchard man gets his land into a condition good enough to grow legumes (clovers of all kinds, including Ladino clover, alfalfa, lespedeza, vetch, etc.) and really grows them in the orchard, he will never need to worry about his soil fertility. So far I have yet to find the farmer who has harmed his land or his farm income by the growing of clovers.

Industries Commended

The word of praise to the chemical fertilizer, and lime industries that I wish to stress is this, they have in the last 15 years worked hard and are able to give a usable complete orchard fertilizer containing as high as 16 per cent nitrogen, 10 per cent phosphate, 8 or 10 per cent potash, along with calcium (with even some of the so-called rare elements, boron, zinc, manganese, copper, iron, magnesium, etc., thrown in).

I have here a jar of a complete orchard fertilizer made in November 1940. It has been in an open bag in a dry wareroom ever since, and it is now usable. It is 16 per cent nitrogen, 10 per cent phosphate, 8 per cent potash (could have been a 10 per cent potash without any trouble). The 16 per cent nitrogen is the same amount of nitrogen you would apply to your orchard when applying nitrate of soda. The nitrogen in this complete fertilizer comes from nitrate of soda, uramon, ammo-phos, cyanamid, and sulphate of ammonia, a nitrogen supply that would not be available to the tree all at the same time but would extend over a longer period of time in the spring than it would if all the nitrogen were from one source like nitrate of soda, sulphate of ammonia, etc. Besides the nitrogen sources there is room in the mixture for enough sulphate and mu-

riate of potash to give 8 per cent and could be 10 per cent potash plus the 10 per cent phosphate. Now besides these 3 important elements of food, there is still room in the mixture for 300 pounds of limestone rock flour, 100 pounds of raw phosphate flour (a good dryer in itself), and 10 pounds of dryer like cocoa shell meal or tobacco stem dust, a mixture with room for the rare elements if wanted.

Yes, I say a word of praise is due the chemical fertilizer industry for making such fertilizer available to the American farmer and fruit grower. A 16-10-8 or a 10-6-4 complete fertilizer could be made that I would not want to use. Let us say one in which all the nitrogen came from one source that was very soluble or fast acting or one made from a nitrogen source that would be slow and long drawn out in its availability. In either case, such a mixture would not be the one I would like to feed my trees.

Prices Based on Units

You will say this complete fertilizer sounds all right but it costs too much money. The price of such a complete fertilizer may sound high, but the fertilizer manufacturer will be making such mixtures as 16-10-8, 16-10-10, 10-6-4, and 10-10-10 and selling them to you growers at the same price per unit of plant food as if you bought your own sources of nitrogen, phosphate, and potash. To be sure, the manufacturer will have to charge for the mixing of a ton of 16-10-10 or 10-6-4. The mixing cost, however, will be no greater than if he mixed a ton of 2-8-4. In 100 pounds of 16-10-10 you get 36 pounds of plant food. In 100 pounds of nitrate of soda you get 16 pounds of plant food. In 100 pounds of superphosphate you get 16 or 20 pounds of plant food, depending on whether you buy 16 or 20 per cent goods. In 100 pounds of sulphate or muriate of potash you get 49 to 60 pounds of plant food. In any mixed complete fertilizer you pay the fertilizer company on the base price of the nitrogen units, the phosphate units, and the potash units. Figure it out for yourself and you'll see that you pay only for the pounds of plant food you get regardless of nitrogen source, phosphate source, or potash source. If we can get to using a good complete fertilizer in early spring soon after the frost is out of the soil, our cover crops will grow better, our grass or legume sods will grow better, and in a few years our tree growth and yields will be better.

Excessive Spray Injurious

We must give a little more thought to the use of lime or limestone under our trees to correct the acid condition of the soil resulting from the use of our sulfur sprays. When the soil under our trees has a covering of green mould-like growth, we can not expect little cover crop seedlings to grow into real plants. Since I have mentioned this spray problem in connection with soil fertility, I might just as well add that many growers are holding back their tree growth by spray damage to the tree leaves. One plant food, carbon, enters the plant by way of the leaf. This element of plant food is just as important to good health and high yields as are nitrogen, phosphate, and potash which enter via the tree roots. I know the plant disease and insect workers think I am wrong, but if a crop of clean apples can be grown with only 1¼ gallons of lime-sulphur (yes, even 1 gallon) to 100 of water, or if 1 pound of bluestone and 2 to 3 pounds of lime to 100 gallons of water will make a bordeaux mixture strong enough for grape, apple, and cherry spraying, then I am all for such sprays. Clean crops have been grown with such weak sprays. In 1942 I am going to try ½ pound of bluestone and 1 pound of lime hydrate to 100 gallons on grape, apple and cherry trees.

I believe much the same as an insect worker once said, "If I could have my way about it, I would have only rain water fall on trees of mine, but unfortunately the bugs and diseases are not killed by rain water."

Referring back to my statement about the importance of growing clover or other legume cover crops and sods, I wish at this time to tell you about and to introduce to most of you a legume cover crop about which there is but little known. It is an old plant, but I never heard of it until November 1939. Extension Agronomist H. R. Cox, New Jersey Agricultural Experiment Station, New Brunswick, New Jersey, knowing my enthusiasm for legume covers asked me how I thought crown vetch would do as a cover. I told him I had never heard of crown vetch. The more he told me about it the better it sounded. He supplied me with about two tablespoons of the seed, enough for a start. We got more and more interested in it as the plants grew in 1940.

In the spring of 1940 John Ruef, extension pomologist of State College, Pennsylvania, came into my office one day with some plant leaves and roots and asked me what the plant might be. The leaves were legume leaves. Just then E. I. Wilde, our florist, came into the office and we asked him what the plant might be. Mr. Ruef told him he understood the plant had a rather pink or pinkish-purple flower when in bloom. Mr. Wilde said it was likely a type of vetch and asked what the seed looked like. Mr. Ruef had some of the seed, and, lo and behold, it was the same seed as the crown vetch I had gotten from Mr. Cox of New Jersey. Where had Mr. Ruef gotten this crown vetch seed and plant? Out of an orchard that was full of it, right in Pennsylvania—the orchard of R. H. H. Aungst, Pine Grove, Schuylkill County. It was growing on this farm when Mr. Aungst planted his orchard. In the early years of the orchard Mr. Aungst thought of it as a weed. He never got rid of this weed, thanks to Old Mother Nature.

Since the spring of 1940 our extension workers have located two other patches of this good weed—a plant of the Coronilla group, perennials, shrubs, and herbs—the crown vetches. Most orchard men know winter or hairy vetch as a good cover crop. If winter vetch is a good cover crop, then crown vetch is a better one for it will spread like quack grass from underground roots or pieces of roots.

In the crop year of 1940, Mr. Cox had children collect by hand in a re-

Young peach tree showing characteristic potash deficiency symptoms (left) and one showing normal growth and development (right).

forestation planting on his farm about 2 quarts of seed for us. This hand seed-collecting work cost us $10. From this seed we now have a stand of the 1941 seeding on about ½ acre of land.

In August 1941, in 3 hours time, I collected by hand with the help of 2 high school boys, 30 quarts of crown vetch seed in Mr. Aungst's orchard. I have become so sure of crown vetch as a fine legume orchard cover crop that I asked Mr. Aungst to collect up to 32 quarts of seed by hand which I told him I would sell at $2 a quart. He said, "$2 a quart is a high price for seed." I told him, "Yes, it is, but any man willing to pay $2 a quart will take care of the seeding he gets from such a seed supply and 1 quart of seed will in 2 years time be supplying him with enough seed for a right sizable orchard seeding." With crown vetch once started, a man's seed supply will be permanent, for it will spread if undisturbed into a solid patch of seed-bearing plants. From our small seeding in the spring of 1940 we learned that it is a great nitrogen collector, the same as winter vetch, clover, and alfalfa.

Seed is Available

Anyone wanting a quart or more of this crown vetch seed can get it from me at the end of this meeting for I have a supply with me done up in one-quart packages. I will supply each man with a printed sheet of instructions for seeding for a seed supply and one quart of crown vetch inoculated soil this fall for his seeding. Our soil is full of the right bacteria or our crown vetch plant roots would not have been so thickly covered with nitrogen nodules at the end of one season's growth.

In a way I feel rather guilty in introducing this crown vetch to you orchard men because of my good fertilizer friends present here today. I know it is a means whereby, through the aid of bacteria, we orchard men can get a lot of nitrogen that will never see a fertilizer bag. We can put a lot of nitrogen into our orchard soil by the use of clovers, alfalfa, vetches, and other legumes, if we use phosphate, potash, and lime in our orchards. At the rate the people in Europe are shooting up nitrogen in the form of gunpowder, maybe we'll have to grow our nitrogen before long anyway.

A word about $2 a quart for vetch seed. Ladino clover was $4 a pound about 10 years ago. Today it is 80¢ a pound. It takes only 1½ to 2 pounds of Ladino clover seed to seed an acre of orchard.

Crown vetch can be grown in the field in condition for machine harvest of seed. In time the seed will be on the market as scarified crown vetch seed so it can be used as a cover seeding in late May, June, or July. The seed I have with me is unhulled and will have to be seeded in the soil frost cracks in November, December, or January, the way nature seeds it. I am having a small supply of seed scarified this winter.

I will not be surprised to see crown vetch partly replace lespedeza as a soil-covering plant since it is more of a perennial type, remaining alive over the winter both in stem above ground and in root below ground, ready to grow strong when spring opens up each year. Crown vetch fills the soil with roots. Lespedeza is an annual plant and new seedings must grow each spring from seed.

Crown vetch as far as I know is not a legume eaten by livestock. In Berks County, Pennsylvania, it is growing on a hillside patch of land in pasture, but the livestock do not eat it. Last week I fed some green fresh-cut crown vetch to two goats and they ate it. No seeds, however, were in this green hay. The seed is very bitter to the taste when you chew it. This bitter taste may be the reason livestock in general do not eat it in this Berks County pasture. We understand the Berks County patch came in when the general field was seeded to alfalfa some 25 years ago.

I wish to thank you, Orchardist

Harry F. Byrd, for the honor you have bestowed upon the orchard work of the Pennsylvania State College when you invited me to speak on the important subject of orchard fertility. I thank your guests for their kind attention, and I trust some good to you all will come from this discussion.

Arguing with Angels

(*From page* 5)

ma just keep up an incessant blather about patriotism and the need for every American to be on his toes. But when their eldest boy was taken by selective service and went to have his eyeteeth cut by a bunch of hard-boiled sergeants, his ma and pa began to whimper. Ma keeps writing tear-splotched letters to Billy, reminding him to keep his fingernails clean and his neckties in order, and to eat the right vitamins and be careful about bad associates. Pa is trying to work up some political pressure so that Billy will get promoted or maybe excused completely.

When Billy came home on a furlough ma wrung her hands and worried because he had to wear such nasty heavy old brogans on his tootsies and spend so much time peeling taters. She tells him he's worth more than "twenty dollars a day once a month" and keeps him in a stew all the time for fear they'll ship his outfit over to Istanbul or Murmansk or somewhere beyond the reach of her missives. Then at her club she wails to the mothers of girls and says they are lucky not to have sons to sacrifice. Maybe she hasn't figured out that for every son there's a sweetheart or a wife; but the way she says it you'd think this whole mess was a put-up job on the mothers of males.

Now I can't believe that's any way to win a war or earn a hunk of peace. I'd rather see it done a la my old auntie, who lost one boy in the first world war and has two grandsons hip deep in this one, both being in the Navy. Sure, she knits for them and packs up stuff to send, but when she writes to the boys on the briny it's all home news and home jokes and family banter, with words of admiration for the way the lads are putting on weight and muscling up. She doesn't egg them on to massacre anyone but she reminds them that every generation of her tribe has seen service and was proud to wear a uniform. Maybe she isn't kidding anybody very much about her deep-down sentiments, but she saves the boys a lot of self-respect and makes them see that an athlete in the navy deserves being rooted for about as much as a football genius. She's wise enough to know that one can't stop a panzer avalanche with nursery mollycoddle, and that the guy who can fight back is the one they let alone the longest.

SO when I pick up a hitchhiker in khaki I never say a word about the way civilians regard the administration or about any bureaucrat's official blunders. All I do is to pry into the soldier's experience about camp routine, Army organization and insignia, and the mechanism of the modern rifle—(of which I care and know little). Anything to show him I'm not spouting sob blubber. And only about one boy in six ever comes back with peevish weeps. Probably most of that was imported from back home, too.

One other way to promote a chunk of good will to men would be for us to wage unswerving mental warfare on our present tendency to get the "dictator complex." Now I know as well as you and a host of commentators (including the high-toned columnists) that some penny-ante participants in public regulatory systems are said to have the bighead bad. But as a rule they get just about so far in their maudlin forays against freedom, whereupon they run

smack up in front of old P. O. (which isn't post office, but public opinion).

This "dictator complex" springs up in all manner of conversation both public and private. Farm spokesmen have done their share of "viewing with alarm" the "awful, menacing centralization of power" and have worn out relays of stenographers and linotype men giving forth their opinions anent the rise of dictators and the decline of what we used to call a democracy.

It strikes me that we have had such a universal background of historic hatred of tyranny and abuse of power that we can be trusted on the whole to keep it in reasonable check, without crying "wolf" every time some puppy yips. It's granted that in times of stress we should have a very strong and unbiased central government, run by men who are not going to back water and pull their punches every time some more or less selfish interest gets in the road and insists that Uncle Sam is an old meany.

By ascribing either incompetence or dictatorship, or both, to our civil leaders I believe we are doing some internal injury to our much-cherished form of public management. Countless election reversals from one party to the other and back again should have taught us vividly that neither side has a patent on statecraft or good leadership. The only way we can find out what dictators really mean when they are put there for keeps is to go right on questioning and slurring our present system—bad in spots though it may be.

THAT'S the best way to acquire dictators, because it's the only kind of leadership able to handle that kind of a mob. Hence I reckon a little piece of patience and tolerance and good will to men in office might save us from the fate of Italy and Germany.

That is, I know if you elected me to a job where I might get dictatorial and arbitrary, my background of horse sense, based on what little history I have picked up, would halt me with a jolt long before I ever convinced myself that you'd stand for tyranny. And that's the way it works with every ordinary American elevated to a post of responsibility—his mind checks him from excesses long before the mob does. There may be a few exceptions, but most of them are victims of their own folly, while America still waves!

If you remember what I started out to say (which I'm not too sure I know myself) you'll recall that we dragged in some angels. I didn't do that because I am a frat brother of any celestial beings or have any special knowledge of harps and halos.

They were brought in to give this essay a Christmas setting in the first place, and then to take a sort of text for lots of us who are so prone to argue with foreordained forces of destiny. While I am not a fatalist, it looks to me as though F. D. R. was right when he said this generation has a date with destiny.

THIS suggests to me that the best kind of holiday spirit we can rig up for ourselves would be to retain confidence in our country and its best customs and vow to keep in tune with that strain of music rather than to dial around for dismal things.

You can cheer up a misanthrope by going at it right. If he feels that this is the last Christmas he'll be able to retain his dollars, his dignity, and his dear ones, then tell him if that's so he'd better perk up and trim the tree a little higher and brighter. Because later on when his nightmare is saddled and ready for his canter to calamity he can look back and grin at the fun they all had once more in the old fond way.

And ten chances to half a one, he will be wrong on that sour note of his; and before the year is out, his stock will be rising and his faith in America and the party he supports will be floating on rosy clouds.

So that's the way I want to ring off. That's the outlook I need myself and so I pass it on to you, adding for good measure to show I have no grudge against Angels—Merry Christmas, Peace on Earth, Good Will toward Men.

"Rastus says Parson Brown done ketch 'im in Farmer Smith's chicken coop."

"M-m, boy! Don't Rastus feel 'shamed?"

"Nossuh, de parson am de one what feel 'shamed. He can't splain how come he ketch Rastus dar!"

Mary: "How is it Bill never takes you to the movies any more?"

Helen: "Well, one evening it rained and we stayed home."

"If you kiss me again, I shall tell father."

"That's an old tale. Anyway, it's worth it," and he kissed her.

She sprang to her feet. "I shall tell father," she said, and left the room.

"Father," she said, softly to her parent when she got outside, "John wants to see your new gun."

"All right, I'll take it in to him," and two minutes later father appeared in the doorway with his gun in his hand. There was a crash of breaking glass as John dived through the window.

"I hear there are twins at the Bate's house. Boys or girls?"

"I think one's a boy and the other a girl—but it may be the other way round."

The only difference between a cutie and an old maid is that the cutie goes out with the Johnnies and the old maid sits home with the willies.

Attorney: "Where was the defendant milking the cow?"

Witness: "It's hard to describe, Judge, but if you'll bring in a cow, I'll show you the exact place."

"Billy's downstairs smoking your cigars . . . he says he won't stop until you lay off his electric trains."

CLOSE FRIENDS

"Ah say, Mary, would you jes's soon—?"

"Look here, Jim Jackson, don't you git fresh wif me. Mah name's Miss Smif, not Mary. I don 'low only mah bes' and mos' pa'ticular friends to call me Mary."

"Ah begs yo' pardon, Miss Smif. But, say, Miss Smif, would you shif' to de oder knee? Dis one's gittin' tired."

I hate to say it just because
It sounds so mean and shocking;
But Nature beat you, Santa Claus,
At filling Peggy's stocking.

When men wore long beards—a wife allowed her husband to play poker twice a month while she had a party of lady friends. The husband came home one night while all were there, his whiskers loaded with tobacco juice.

Wife: "Dear me, John, couldn't you turn your head to spit?"

Husband: "Nope, not in that game."

FERTILIZER *Films* AVAILABLE

WE shall be pleased to loan to agricultural colleges and experiment stations, county agricultural agents, vocational teachers, responsible farm organizations and members of the fertilizer trade, films bearing on the proper use of fertilizers, particularly potash. Anyone interested in showing these films should direct his requests to our Washington office.

Potash in Southern Agriculture

Covers fertilization and potash deficiency symptoms of cotton, tobacco, and corn at several Experiment Stations in the South, also crops in the field, fertilizer placement work, and scenes in a fertilizer factory.

16 mm.—sound, color—running time 20 min. (on 800 ft. reel).

Bringing Citrus Quality to Market

Shows influence of fertilizers, particularly potash, on yield and thickness of rind, volume of juice, weight, and general appearance of citrus fruit.

16 mm.—silent, color—running time 25 min. (on 800 ft. reel).

New Soils From Old

Experimental work on Illinois Soil Experiment Fields and the benefits from a balanced soil fertility program using limestone, phosphates, and potash in growing corn, wheat, clover, and other crops.

16 mm.—silent, color—800 ft. edition running time 25 min.; 1,200 ft. edition running time 45 min. (on 400 ft. reels).

Ladino Clover Pastures

Determining proper fertilization of Ladino Clover for best utilization as pasture for livestock and poultry in California.

16 mm.—silent, color—running time 25 min. (on 400 ft. reels).

Potash Deficiency in Grapes and Prunes

Effects of potash deficiency and fertilizer treatments on grapes and prunes in California.

16 mm.—silent, color—running time 20 min. (on 400 ft. reel).

Machine Placement of Fertilizer

Methods of applying fertilizer to California orchards, lettuce, and sugar beets with various types of apparatus devised by growers.

16 mm.—silent, color—running time 20 min. (on 400 ft. reel).

Potash From Soil to Plant

Sampling and testing soils by Neubauer method to determine fertilizer needs and effects of potash on Ladino clover in California.

16 mm.—silent, color—running time 20 min. (on 400 ft. reel).

Requests for these films *well in advance* should include information as to group before which they are to be shown, date of exhibition, and period of time of loan.

AMERICAN POTASH INSTITUTE, INC.

1155 Sixteenth Street **Washington, D. C.**

Printed in U. S. A.